

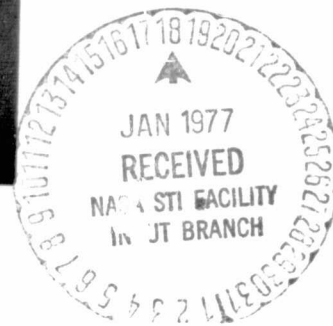
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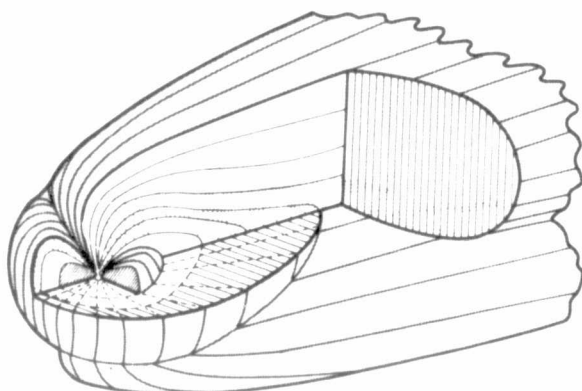
(NASA-TM-X-72607) IMS/SATELLITE SITUATION
CENTER REPORT: ORBIT PLOTS AND BAR CHARTS
FOR PROGNOZ 4, DAYS 1-91 1976 (NASA) 116 p
HC A06/MF A01 CSCL 22A

N77-15054

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IMS/Satellite Situation Center Report

Orbit Plots and Bar Charts
for Prognoz 4, Days 1-91 1976



REPORT NO. 8

DECEMBER 1976

IMS/Satellite Situation Center Report

Orbit Plots and Bar Charts for Prognoz 4

Days 1-91 1976

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National Space Science Data Center/
World Data Center A for Rockets and Satellites
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

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I. INTRODUCTION

This report contains orbit plots for the Prognoz 4 satellite for the time period January-March 1976. This satellite has been identified as a possible important contributor to the International Magnetospheric Study (IMS) project. The orbits are based on an element epoch of December 26, 1975, 3h 8 min and 17s. The elements are given in Table 1 and correspond to orbit number 2. In view of the low perigee of this satellite, the Satellite Situation Center (SSC) considers that the effect of atmospheric drag precludes orbit predictions for the length of time normally used by the SSC for high-altitude satellites. Consequently, orbit data are shown for the first 3 months of 1976 only. A second set of elements, corresponding to orbit number 10, is shown in Table 1. Both epochs correspond to the satellite at the ascending node. The orbit generated for this report is based on the earlier epoch, and it positions the satellite within 30s of the ascending node at the later epoch. Therefore, within the accuracy of the plots shown in this report, the orbit used may be regarded as an achieved orbit. The orbit information is displayed graphically in four ways: bar charts, geocentric solar ecliptic plots, boundary plots, and solar magnetic latitude versus local time plots.

The most concise presentation is the bar charts given in Appendix A. The bar charts give the crude three-dimensional position of the satellite for each magnetospheric region. Each page contains information for 4 days, and the length of the time axis corresponds to the IMS standard scale of 1 cm/h. A three-letter mnemonic is used to represent the various regions of space through which the Prognoz 4 satellite passes:

INP: interplanetary medium
SHE: magnetosheath
SPH: magnetosphere

When the satellite is in the magnetosheath or the magnetosphere, two lines of information are included beneath the mnemonic. The upper line corresponds to the latitude of the satellite, and the lower line corresponds to the local time of the satellite in the Solar Magnetic (SM) coordinate system. In the SM system, the Z-axis contains the north magnetic pole, and the Y-axis is perpendicular to the Earth-Sun line toward dusk. When the satellite is in the interplanetary medium, a third line is added corresponding to the distance, in Earth radii, between the satellite and the Earth's bow shock wave; the notation, \bar{r} , denotes a negative distance and indicates that the satellite is on the convex side of the bow shock boundary. Fairfield's model for the average position of the bow shock has been used (Fairfield, 1971). This model corresponds to a solar wind bulk speed of 420 km/s. A vertical line is drawn when the satellite crosses from one region to the next. The boundary crossings, bow shock (S) and magnetopause (P), appear at the crossing time above the satellite box. Fairfield's model for the average position of the magnetopause boundary has been used.

In Appendix B, the orbit plots of Prognoz 4 are shown in a Geocentric Solar Ecliptic (GSE) X-Y projection. In the GSE coordinate system, the X-axis is along the Earth-Sun line toward the Sun, and the Z-axis is perpendicular to the ecliptic plane such that the Y-axis is toward dusk. In the projection used, a cylindrical rotation of the Y and Z components of the satellite radius vector has been performed at constant X in order to show the relative positions of the satellite and the magnetopause and bow shock boundaries. Each GSE plot contains approximately 3 days of ephemeris data indicated by the start and stop time at the base of each plot. Approximate boundary crossing times are indicated by tick marks on the projected orbit. More accurate boundary crossing times are given by the bar charts presented in Appendix A and the boundary plots presented in Appendix C. The distance of the satellite from both bow shock (S) and magnetopause (P) can be determined for any given time. The

actual distance plotted is the projection of the distance between the satellite and the boundary onto the normal to the boundary drawn at the intersection of the boundary and the satellite-Earth line. Positive distances are on the concave side of the surfaces. On a second frame, the ecliptic latitude and longitude are shown in order to give a three-dimensional image of the satellite position. Each frame covers a 24-h period, and only those days are shown for which a boundary crossing occurs.

On many of the boundary plots, a sharp discontinuity can be seen. This indicates that the satellite radial distance becomes less than 4 Earth radii. The distance to the boundaries is not shown for these radial distances and appears as a default value of either +20 Earth radii or -20 Earth radii.

Because Prognoz 4 lies in a high-inclination orbit, it passes close to the direct access or cusp region. In Appendix D, the Prognoz 4 orbit is shown projected onto the surface of the Earth in the SM latitude-local time plane. The northern and southern cusp regions are shown as broken lines. Following *Heikkila* (1972), the cusp region is taken as magnetic local times in the range of 8h to 16h and magnetic latitudes in the range of 75° to 80° north or south. With this type of projection, the satellite may appear to be in the cusp when, in reality, it is in the magnetosheath. These instances are indicated on the plot. Each plot contains approximately 3 days of ephemeris data indicated by the start and stop times at the base of the plot.

II. PROGNOZ 4 ORBIT CHARACTERISTICS FOR DAYS 1-91 1976

As may be seen from the GSE plots in Appendix B, the apogee of Prognoz 4 for the time period covered lies in the interplanetary medium. Consequently, the satellite does not enter the magnetotail and, on the average, spends 64.4 percent of the time in the interplanetary medium, 7.2 percent in the dayside magnetosheath, 11.2 percent in the nightside magnetosheath, 6.2 percent in the dayside magnetosphere, and 11.0 percent in the nightside magnetosphere. These percentages vary only a small amount on a per-revolution basis.

It may be seen from the boundary plots in Appendix C that most boundary encounters occur at high latitudes as a consequence of the high inclination of the satellite. The times of the boundary encounters are listed in Table 2 for the bow shock and in Table 3 for the magnetopause. For most of the time period, the inbound encounters occur on the dayside, and the outbound encounters on the nightside.

Although Prognoz 4 is a high-inclination satellite, no encounters with either the northern or southern cusp regions are observed. However, this region is highly variable, and a number of close approaches may be observed in the SM plots in Appendix D. (These plots should be used with the GSE plots in order to determine if the satellite is inside the magnetosphere.)

III. SPACECRAFT EXPERIMENT BRIEF DESCRIPTIONS

Spacecraft Common Name - Prognoz 4

NSSDC ID - 75-122A

Last Reported State - Launched and Operating Normally

Launch Date - 12/22/75

Sponsoring Country/Agency

U.S.S.R./Academy of Sciences

Orbit Parameters

See Table 1

Spacecraft Personnel

Scientific Coordinator - A. A. Galeev.....Space Research Institute
Academy of Sciences
Moscow
U.S.S.R.

Spacecraft Brief Description

The spacecraft is a contribution to the IMS program that carries experiments to investigate solar corpuscular, X-ray, and radio emissions as well as to measure energetic particles, plasma, and magnetic fields in the magnetosphere and the interplanetary medium. In a cooperative program with scientists of the Socialist countries, sounding rockets will be launched to altitudes greater than 500 km to study the interaction of shortwave solar radiation with the atmosphere and ionosphere and to make in situ measurements of various parameters in these regions of space.

Experiment Name - Three-Axis Fluxgate Magnetometer

NSSDC ID - 75-122A-01

Last Reported State - Launched and operating normally at the standard data acquisition rate since 12/22/75.

Experiment Personnel (PI = Principal Investigator)

PI - Sh. Sh. Dolginov.....IZMIRAN
Academy of Sciences
Moscow
U.S.S.R.

Experiment Brief Description

The instrument is a three-axis fluxgate magnetometer with a single range sensitive to field intensities of 0 to 600 gammas. The residual field is approximately 1 gamma.

Experiment Name - Plasma Detector

NSSDC ID - 75-122A-02

Last Reported State - Launched and operating normally at the standard data acquisition rate since 12/22/75.

Experiment Personnel (PI = Principal Investigator)

PI - K. I. Gringauz.....Space Research Institute
Academy of Sciences
Moscow
U.S.S.R.

Experiment Brief Description

The instrument consists of a differential ion probe that measures the spectrum between 0.1 and 4.4 keV and an electron probe that measures the density and temperature for energies less than 300 eV. Because of the nature of the orbit, plasma parameters will be obtained in the solar wind, magnetosphere, and plasmasphere.

Experiment Name - Solar X Rays

NSSDC ID - 75-122A-03

Last Reported State - Launched and operating normally at the standard data acquisition rate since 12/22/75.

Experiment Personnel (PI = Principal Investigator)

PI - G. Ye. Kacharov.....Physical-Technical Institute
Academy of Sciences
Leningrad
U.S.S.R.

Experiment Brief Description

The instrument measures X rays in the energy range 2-511 keV.

Experiment Name - Energetic Particles and Charge Composition

NSSDC ID - 75-122A-04

Last Reported State - Launched and operating normally at the standard data acquisition rate since 12/22/75.

Experiment Personnel (PI = Principal Investigator)

PI - Yu. I. Logachev.....Institute of Nuclear Physics
Moscow State University
Moscow
U.S.S.R.

PI - I. A. Sanenko.....Institute of Nuclear Physics
Moscow State University
Moscow
U.S.S.R.

Experiment Brief Description

The instrument consists of various detectors to measure the spectra, anisotropy, and charge composition. The charge composition at energies above 500 MeV per nucleon is obtained at charge values for Z from 2 to 6, 6 to 15, 15 to 35, and 35 to 50.

Experiment Name - Kilometric/Hectometric Receiver

NSSDC ID - 75-122A-05

Last Reported State - Launched and operating normally at the standard data acquisition rate since 12/22/75.

Experiment Personnel (PI = Principal Investigator)

PI - Slysh.....	Space Research Institute
	Academy of Sciences
	Moscow
	U.S.S.R.
PI - Grigoreva.....	GAISH
	Academy of Sciences
	Moscow
	U.S.S.R.

Experiment Brief Description

The instrument is a receiver-antenna system that measures radio emission in the 50-1000 kHz band in 10 frequency intervals.

REFERENCES

Fairfield, D. H., "Average and Unusual Locations of the Earth's Magnetopause and Bow Shock," J. Geophys. Res., 76, 28, 6700, October 1971.

Heikkila, W., "Penetration of Particles into the Polar Cap Regions of the Magnetosphere," Critical Problems of Magnetospheric Physics, Proceedings of the Joint COSPAR/IAGA/URSI Symposium, Madrid, May 1972.

Table 1. ORBIT PARAMETER SUMMARY TABLE FOR PROGNOZ 4

International ID	1975-122A	1975-122A
Epoch (YY-MM-DD-HH-MM-SS)	75-12-26-03-08-17	76-01-26-23-42-11
Period (min)	5785.50	5778.17
Eccentricity	0.93447	0.92976215
Inclination (deg)	64.99	65.28
R.A. of Ascending Node (deg)	157.802	156.681
Argument of Perigee (deg)	289.998	289.57396
Mean Anomaly (deg)	1.112	1.247
Semimajor Axis (km)	106755.22	106664.70
Perigee Height (km)	617.58	1113.74
Apogee Height (km)	200136.56	199459.34

Table 2. PROGNOZ 4 BOW SHOCK CROSSINGS, DAYS 1-91 1976

Time (day/h)	Time (day/h)	Time (day/h)
2/11.48	34/10.91	63/17.94
3/21.23	35/19.35	66/7.96
6/11.55	38/10.64	67/17.68
7/20.93	39/19.09	70/7.47
10/11.57	42/10.38	71/17.45
11/20.63	43/18.89	74/6.98
14/11.60	46/10.12	75/17.33
15/20.39	47/18.79	78/6.42
18/11.61	50/9.79	79/17.16
19/20.26	51/18.65	82/5.78
22/11.54	54/9.37	83/16.87
23/20.09	55/18.40	86/5.10
26/11.37	58/8.93	87/16.59
27/19.82	59/18.17	90/4.39
30/11.16	62/8.46	91/16.31
31/19.58		

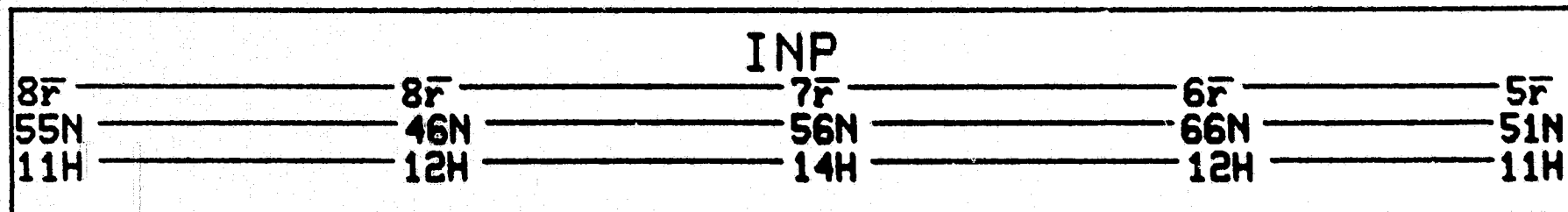
Table 3. PROGNOZ 4 MAGNETOPAUSE CROSSINGS, DAYS 1-91 1976

Time (day/h)	Time (day/h)	Time (day/h)
2/19.26	34/16.62	63/6.35
3/10.90	35/8.59	66/13.32
6/18.95	38/16.23	67/5.95
7/10.58	39/8.25	70/12.89
10/18.64	42/15.87	71/5.58
11/10.26	43/7.96	74/12.47
14/18.35	46/15.52	75/5.27
15/9.99	47/7.73	78/11.99
18/18.08	50/15.12	79/4.91
19/9.78	51/7.46	82/11.47
22/17.76	54/14.68	83/4.45
23/9.54	55/7.09	86/10.95
26/17.40	58/14.23	87/3.99
27/9.23	59/6.72	90/10.41
30/17.01	62/13.78	91/3.52
31/8.90		

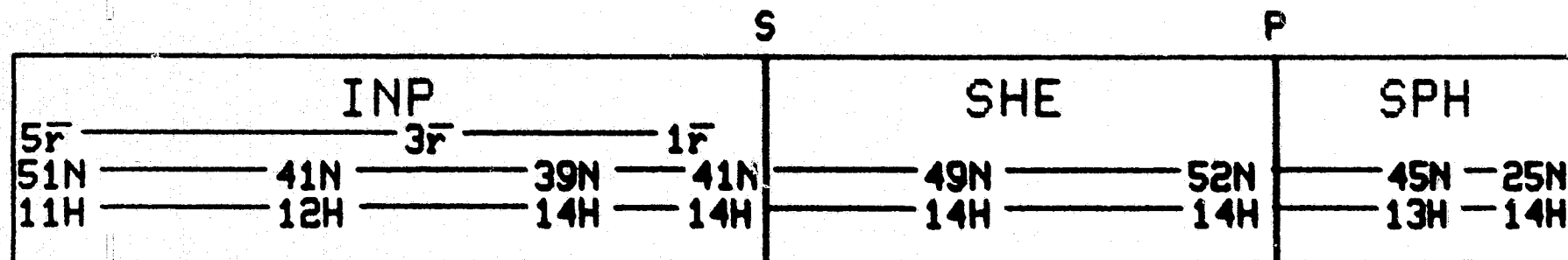
APPENDIX A

BAR CHARTS

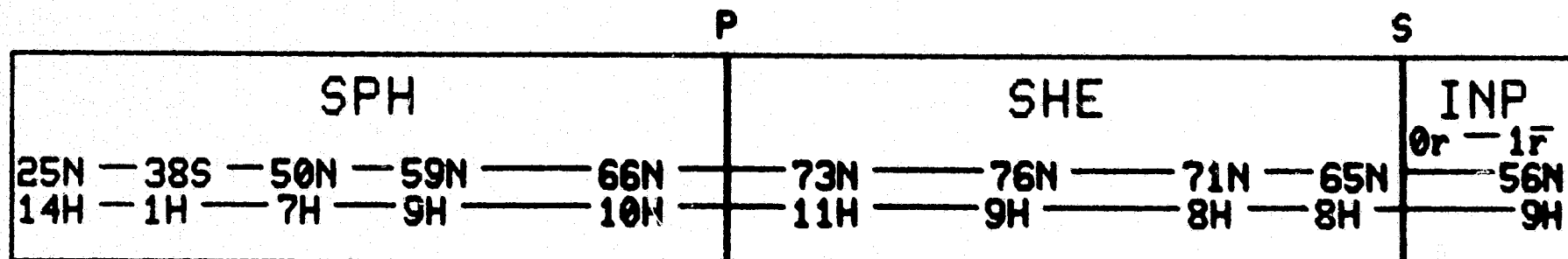
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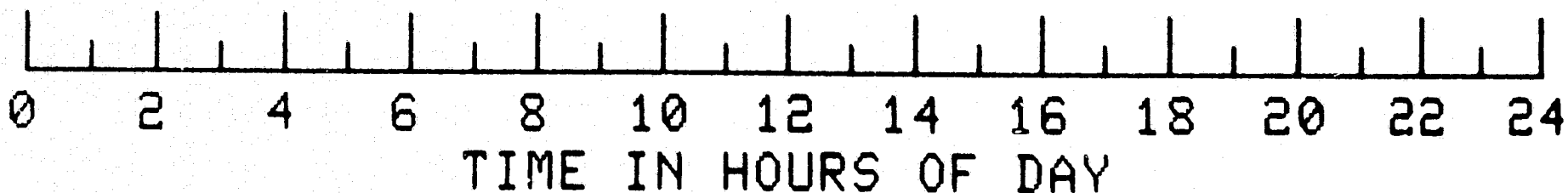
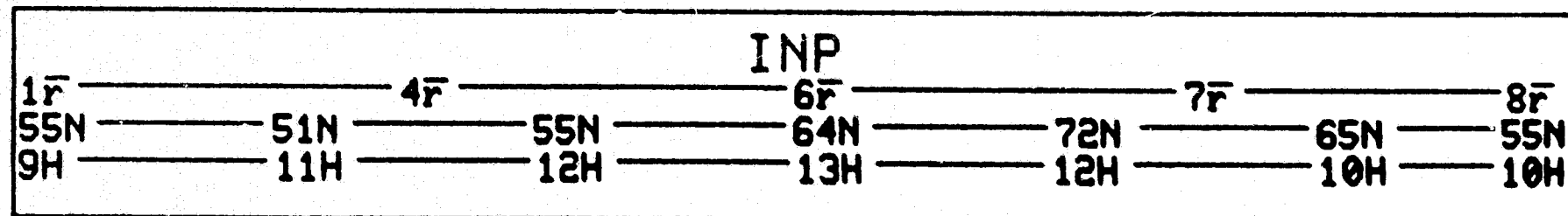
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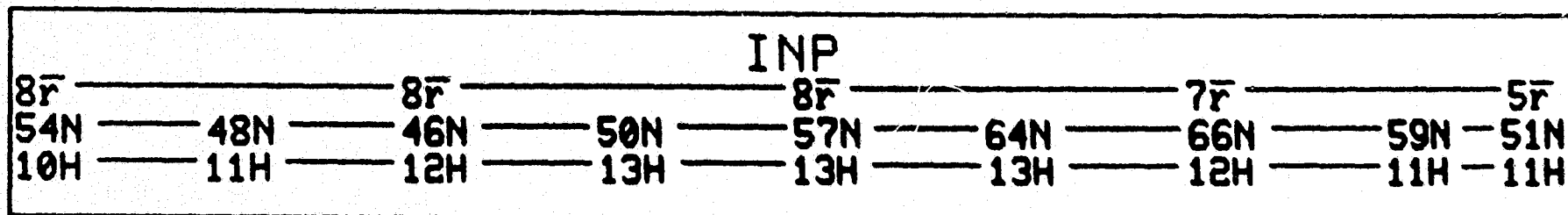
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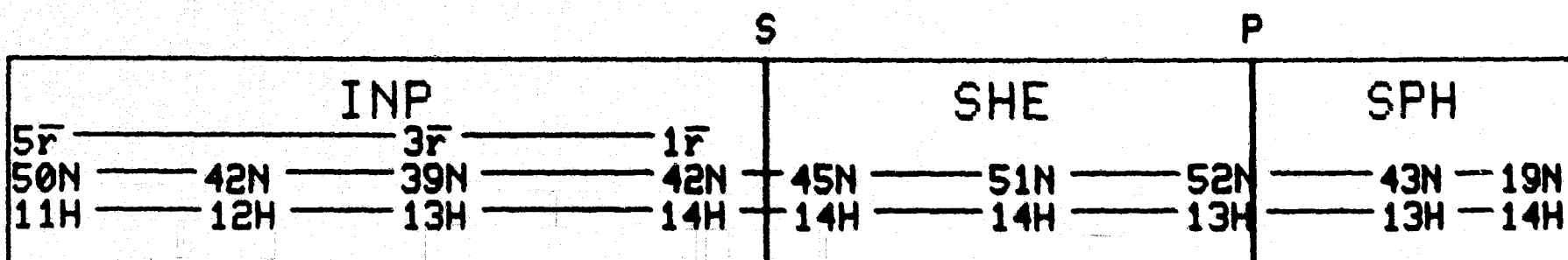
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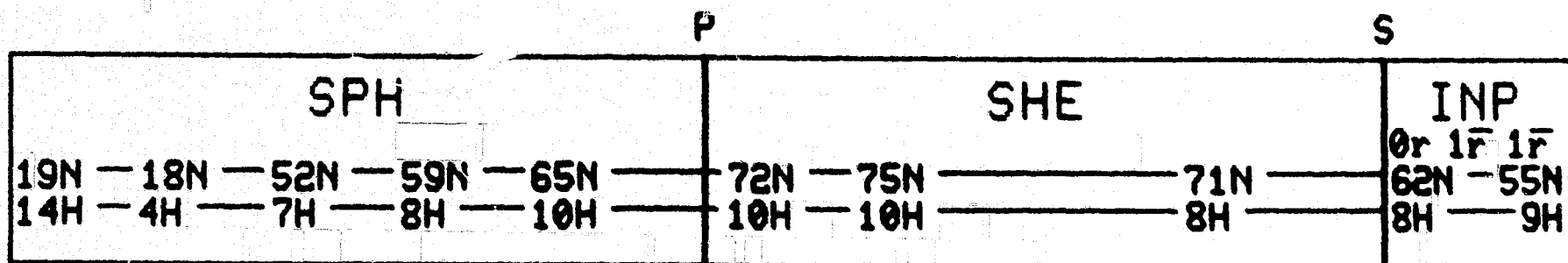
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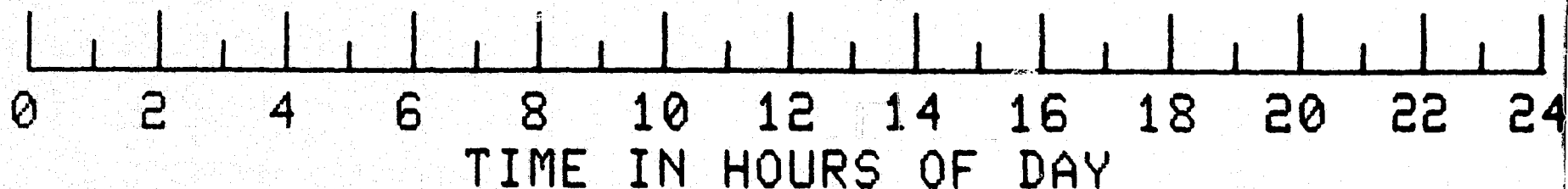
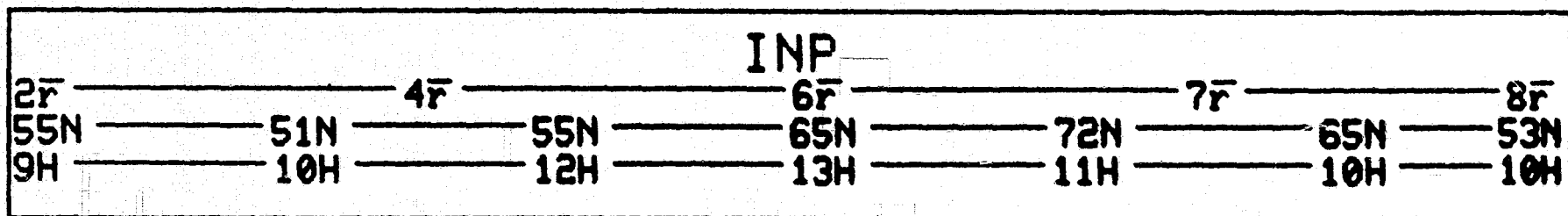
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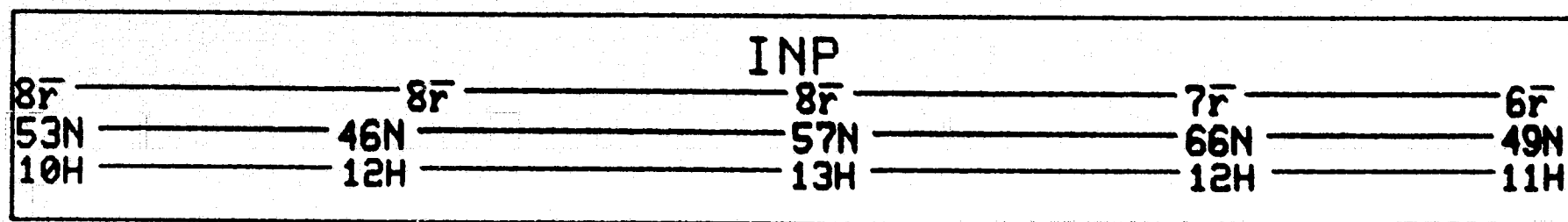
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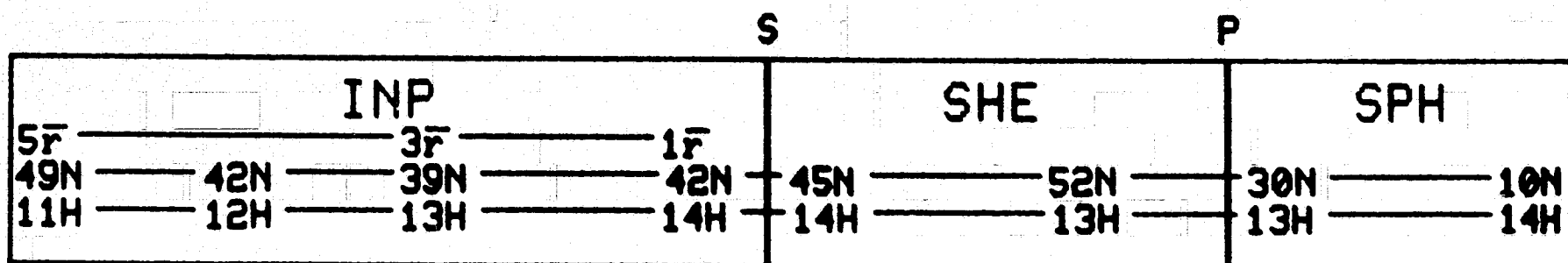
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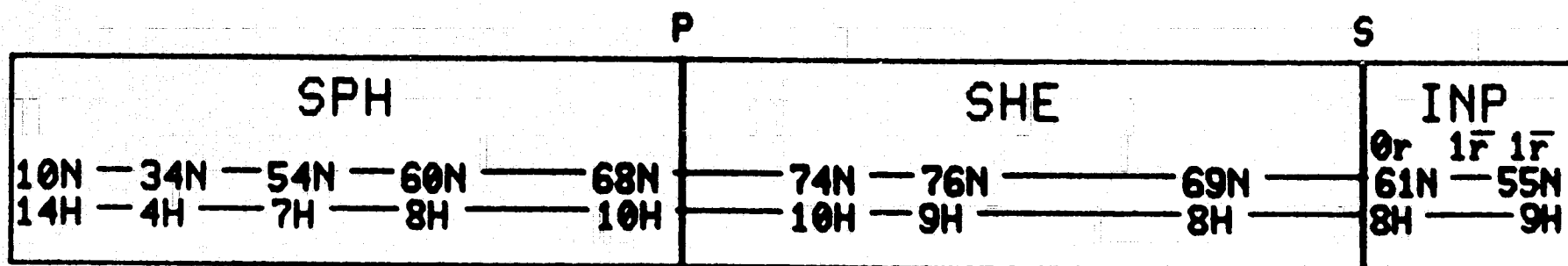
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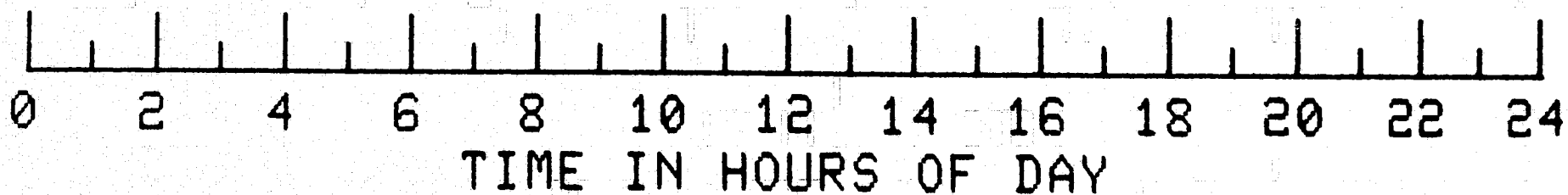
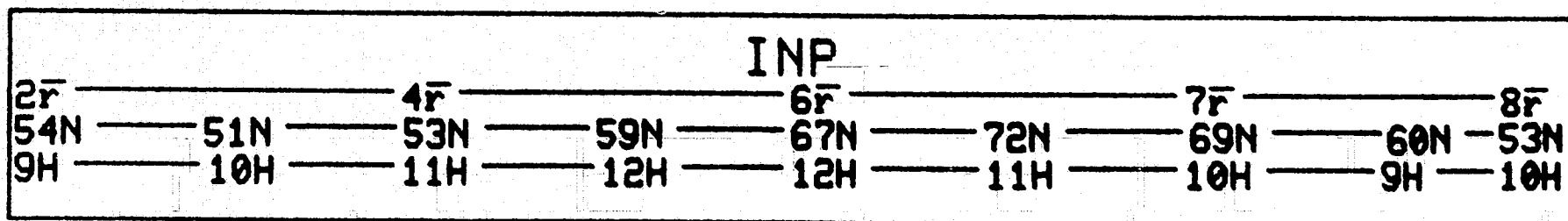
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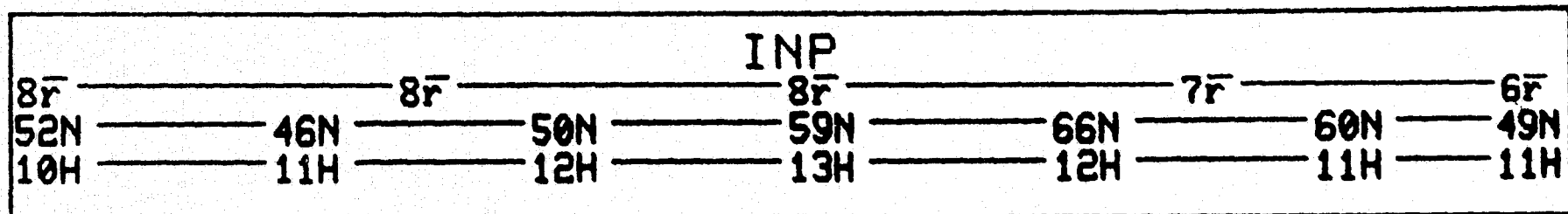
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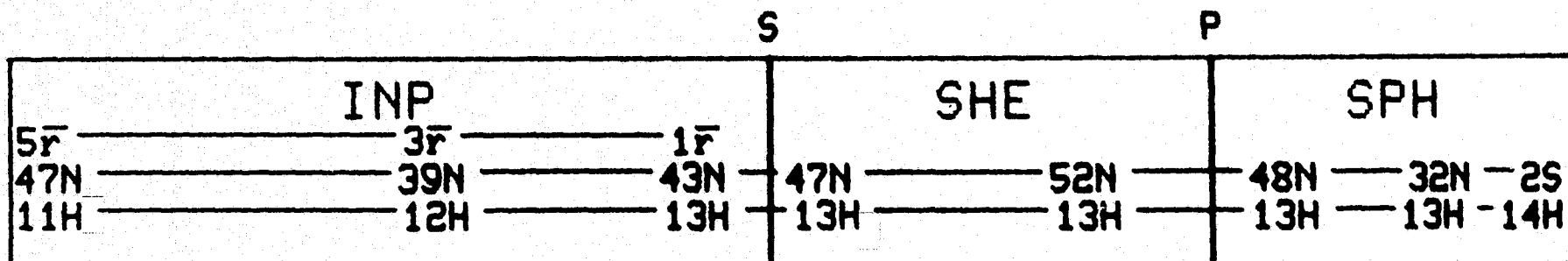
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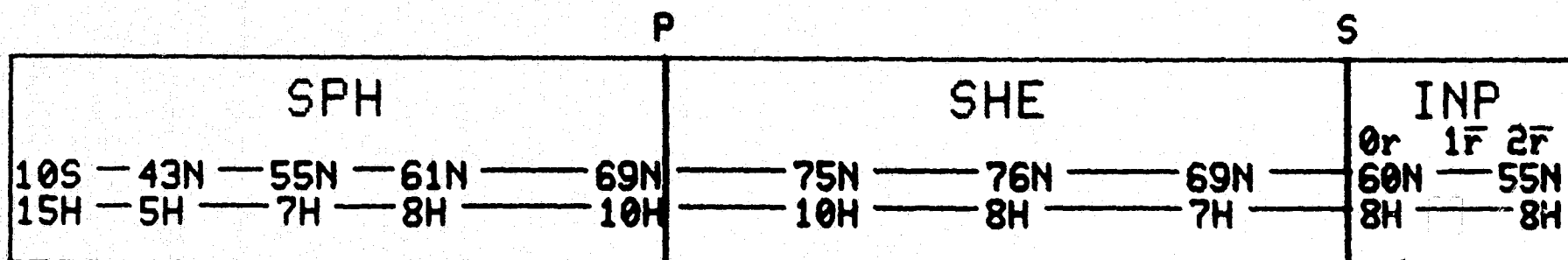
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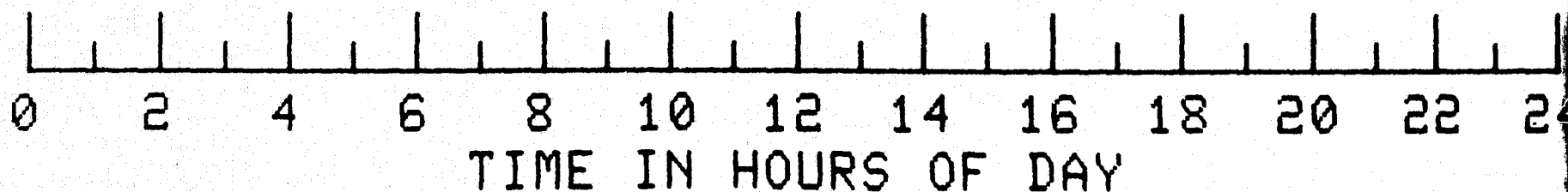
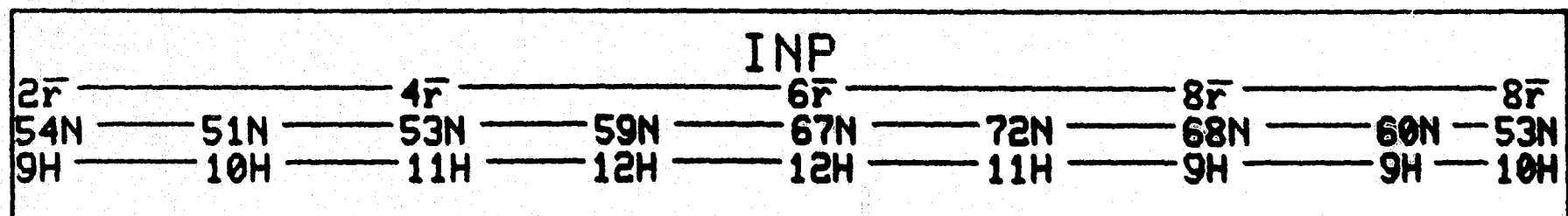
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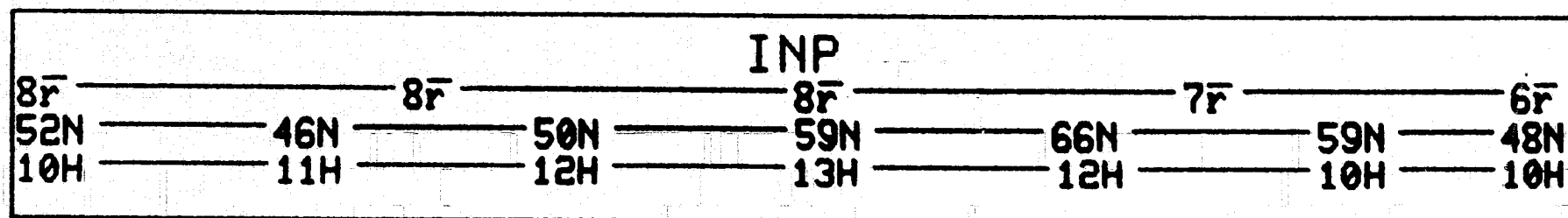
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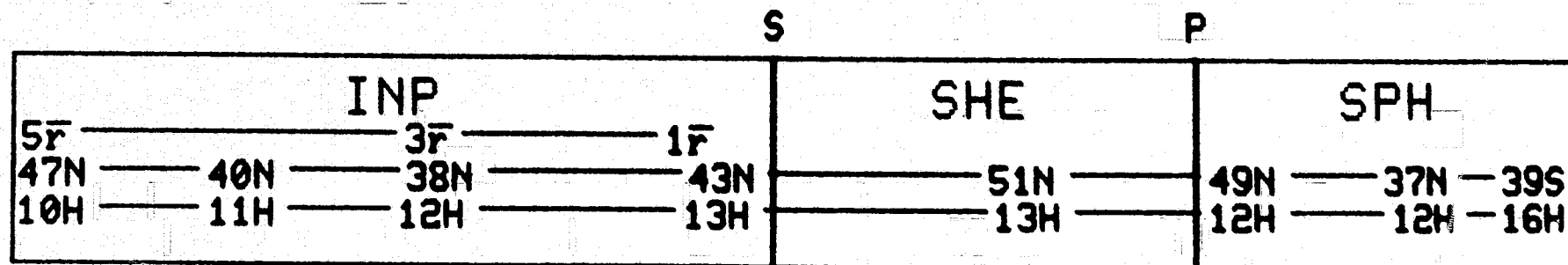
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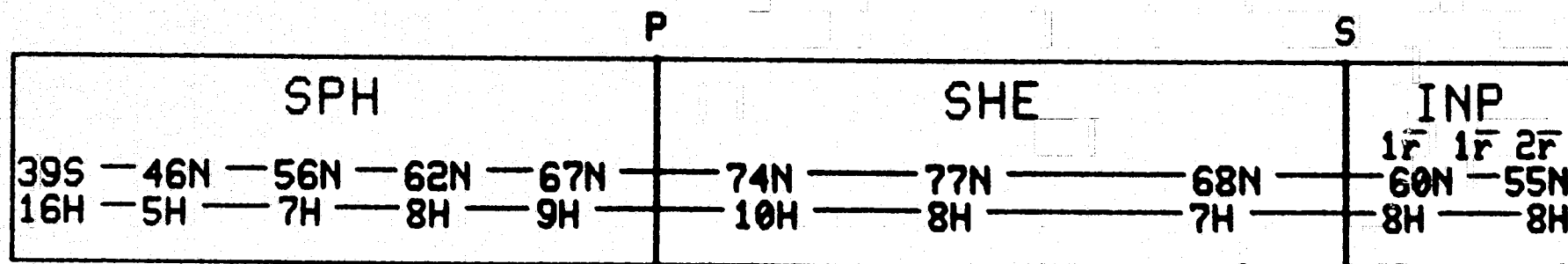
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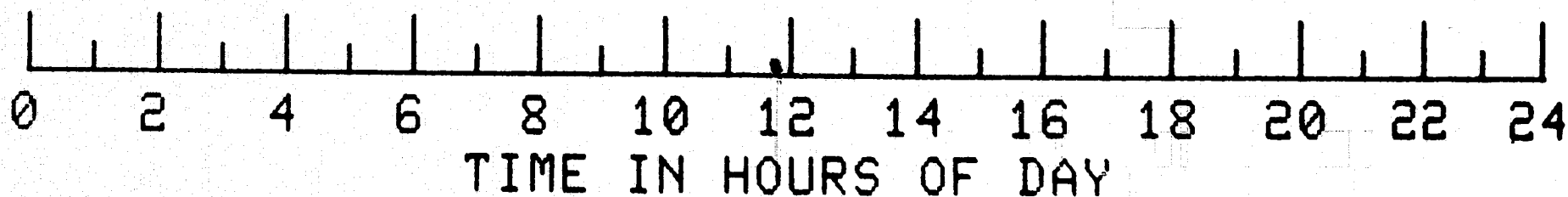
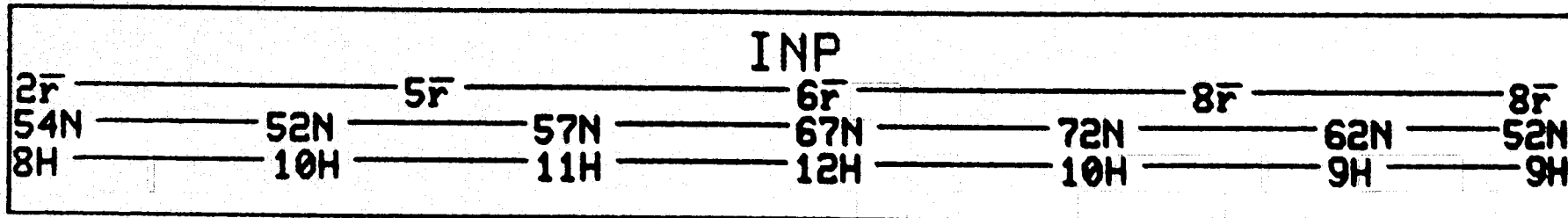
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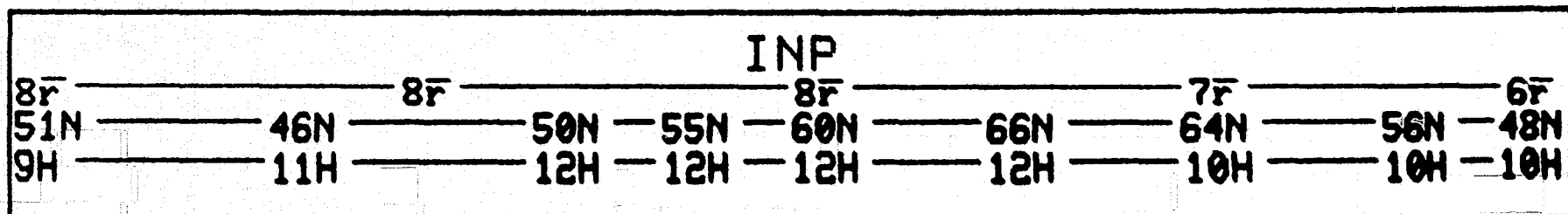
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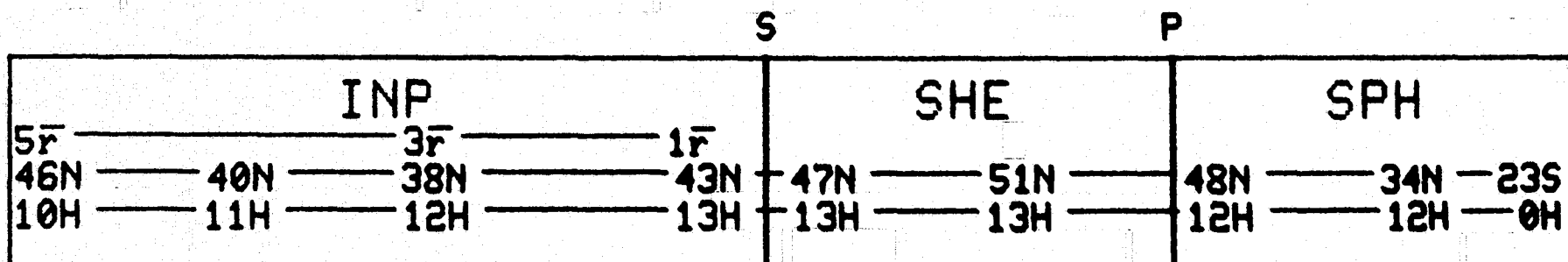
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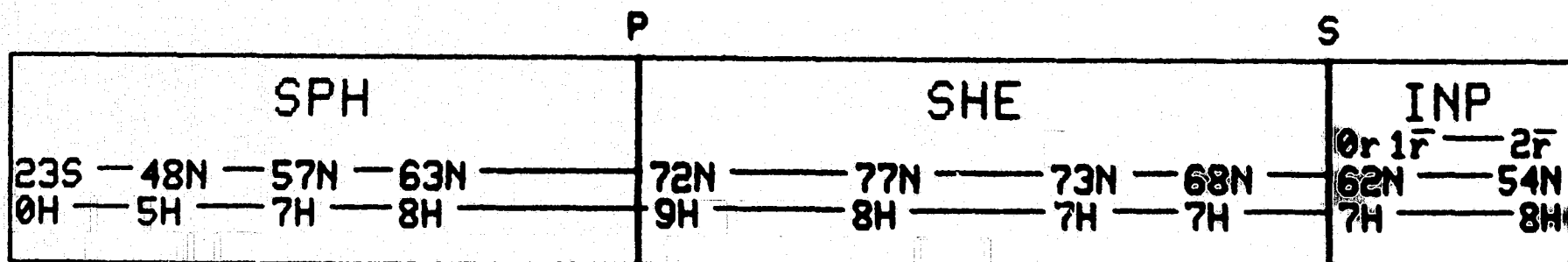
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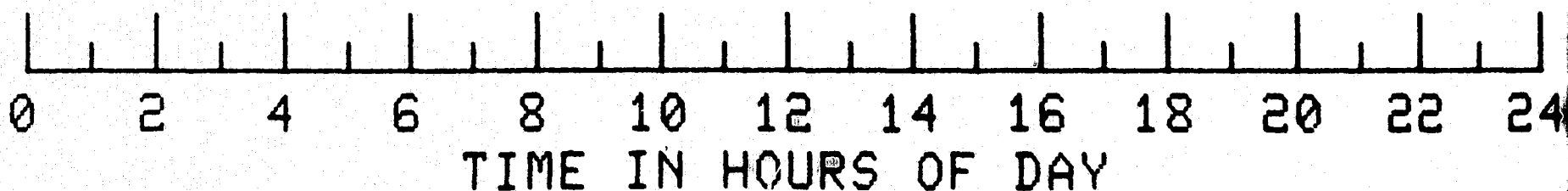
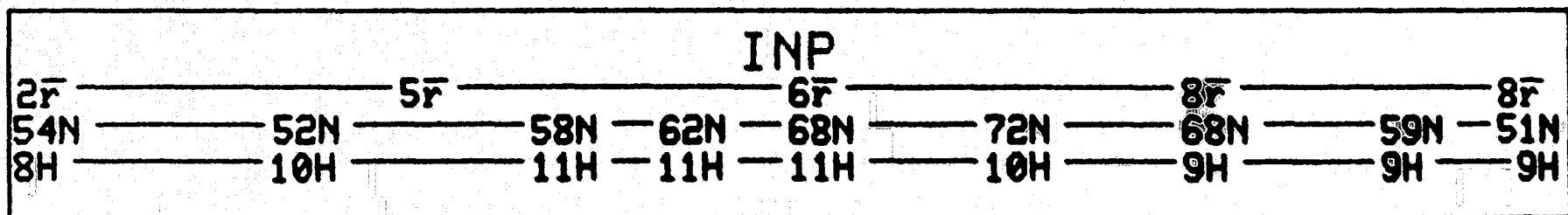
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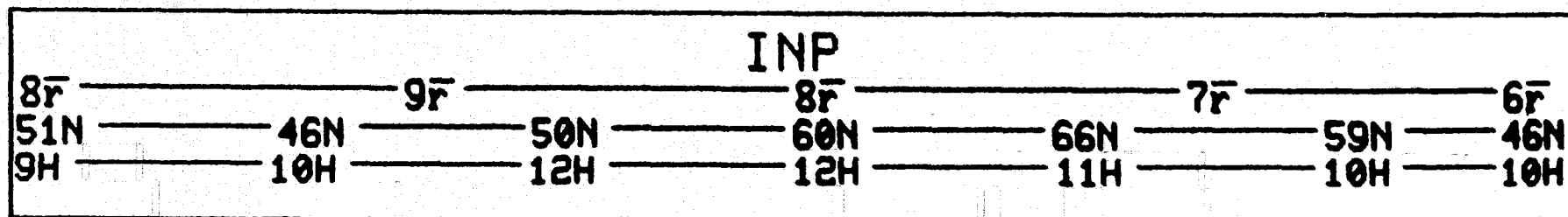
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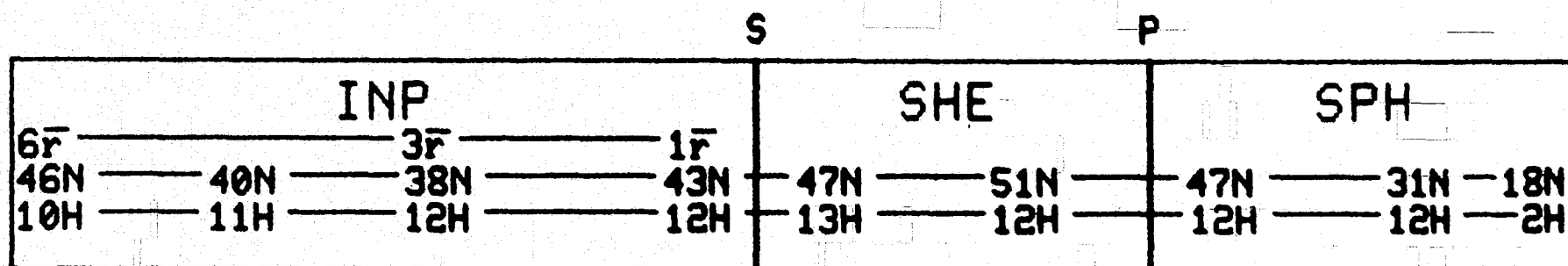
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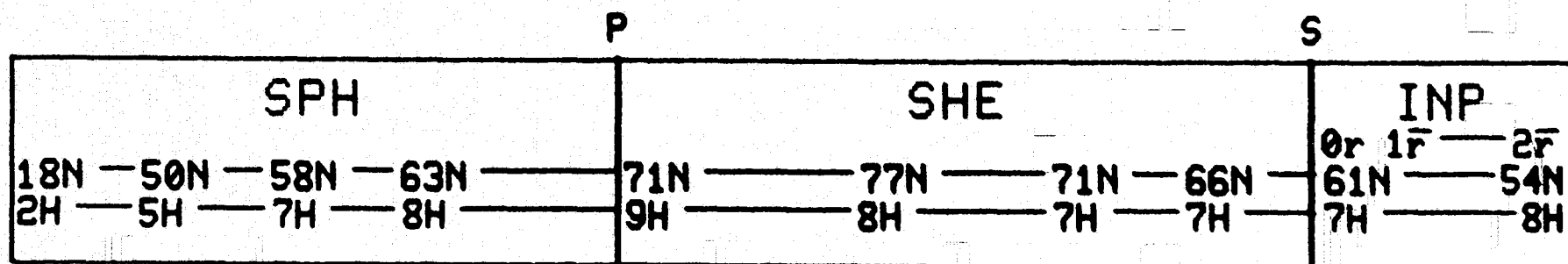
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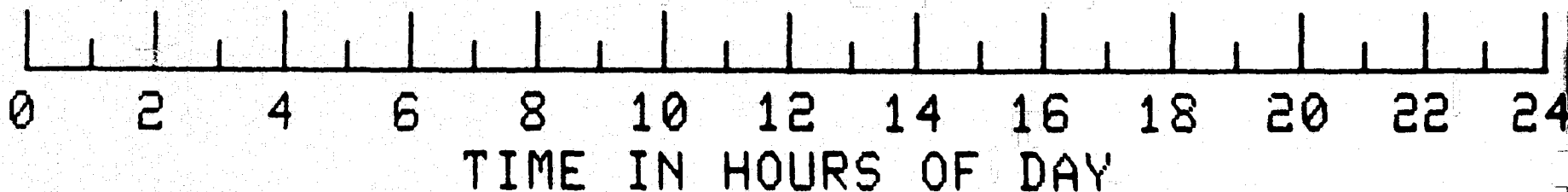
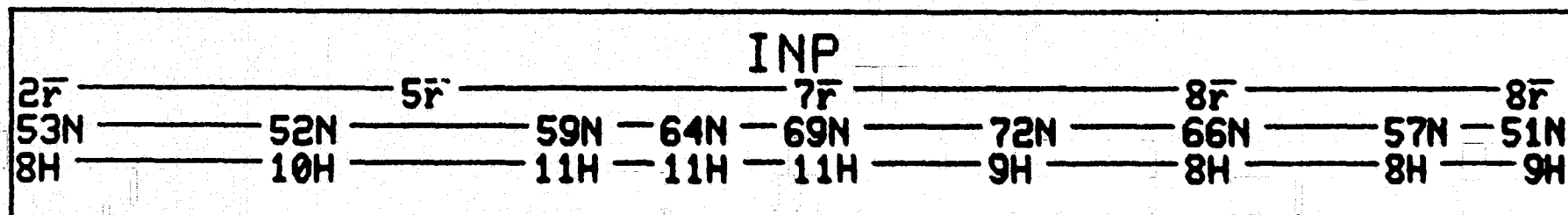
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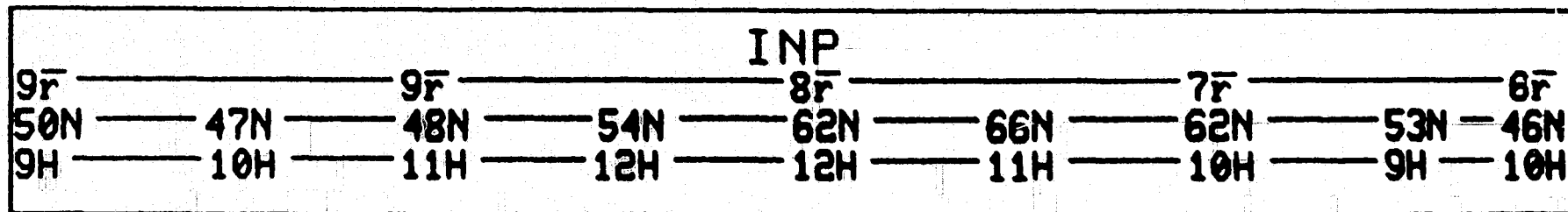
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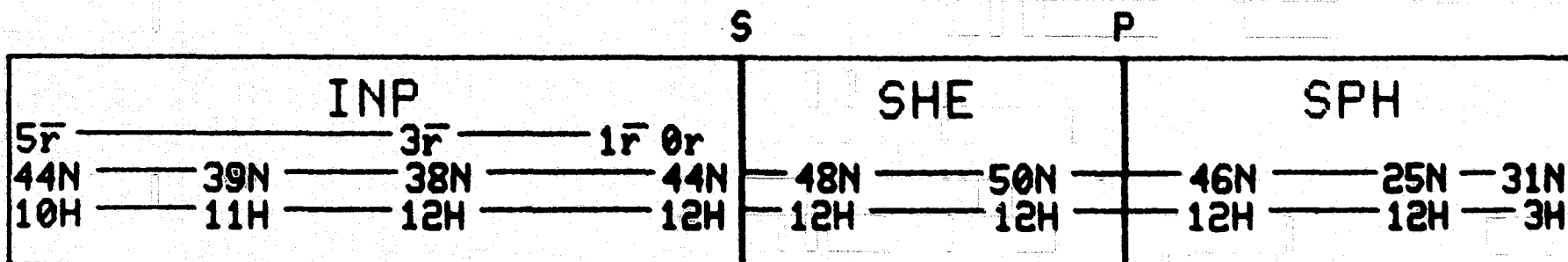
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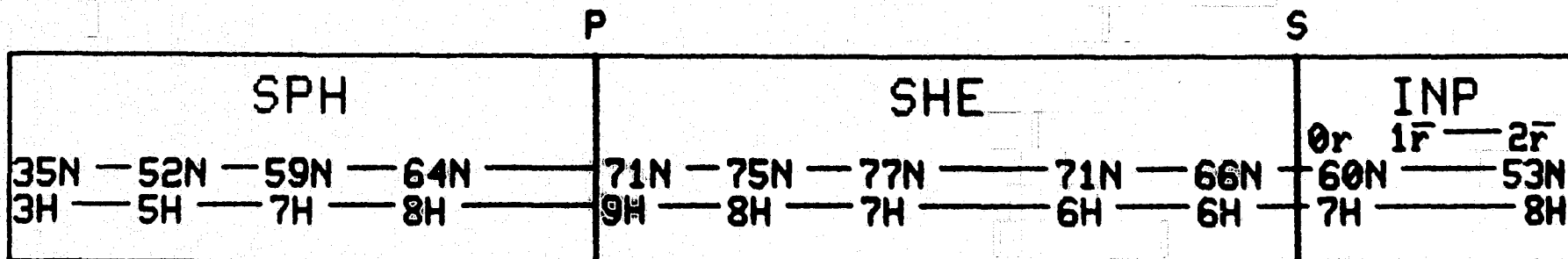
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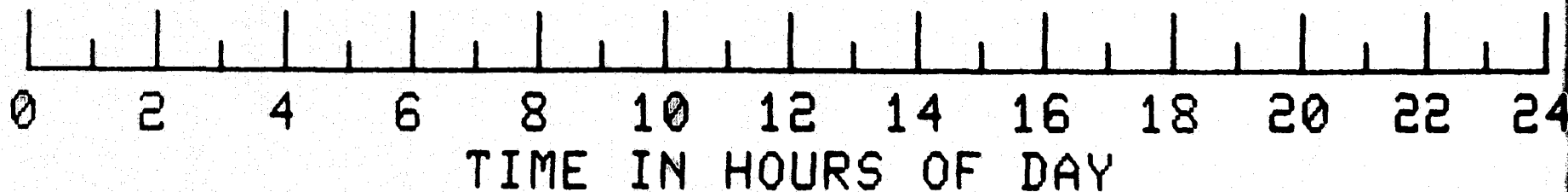
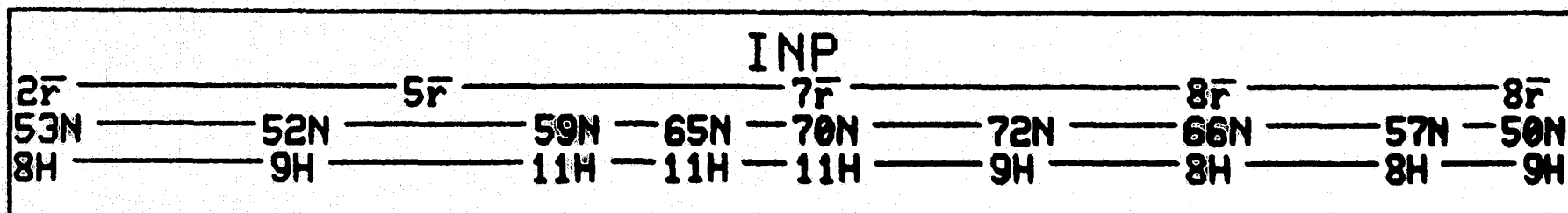
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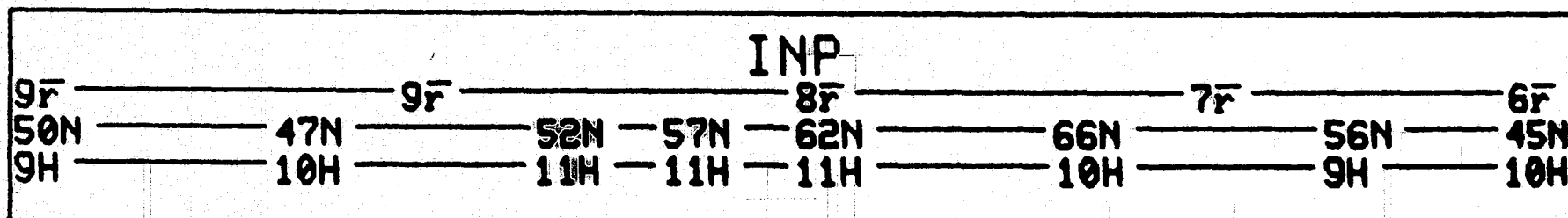
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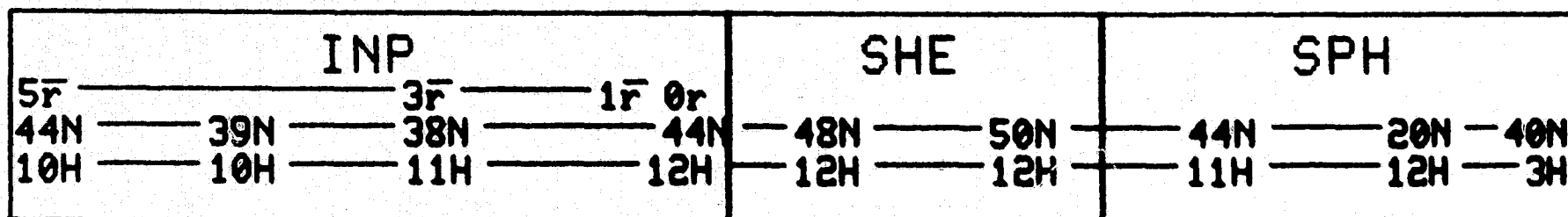
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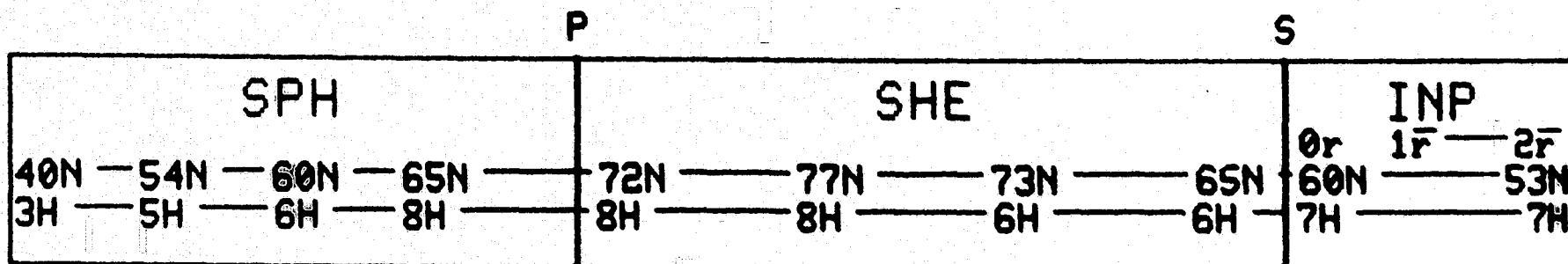
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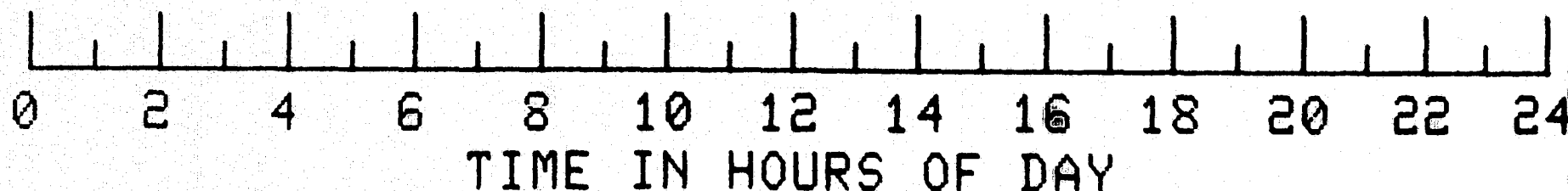
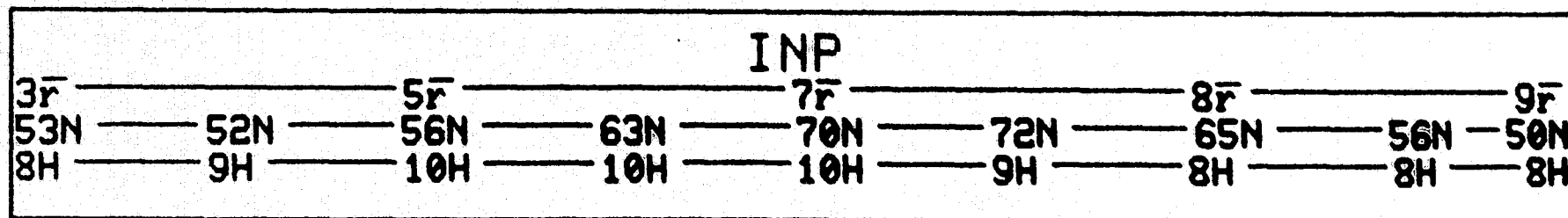
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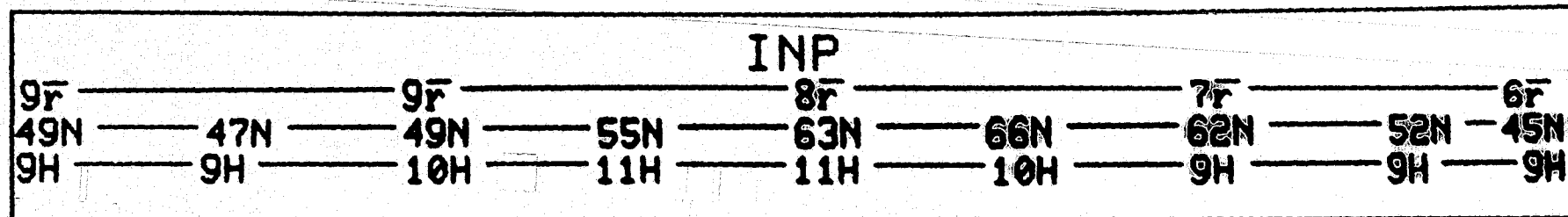
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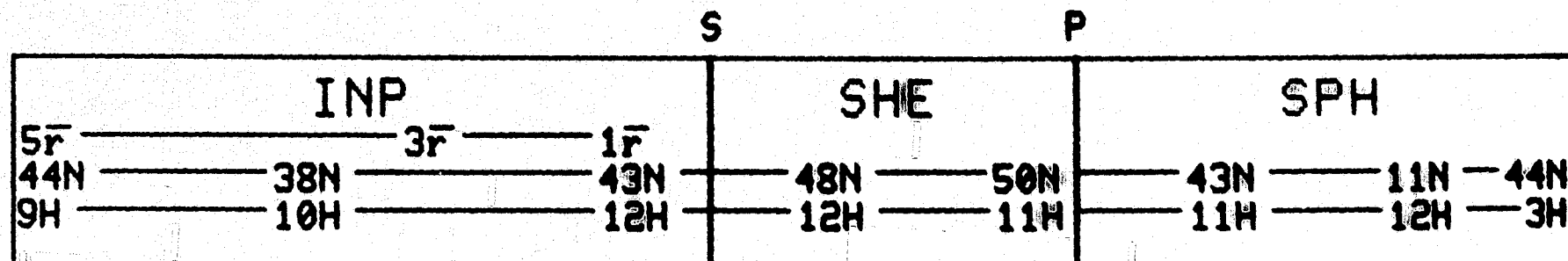
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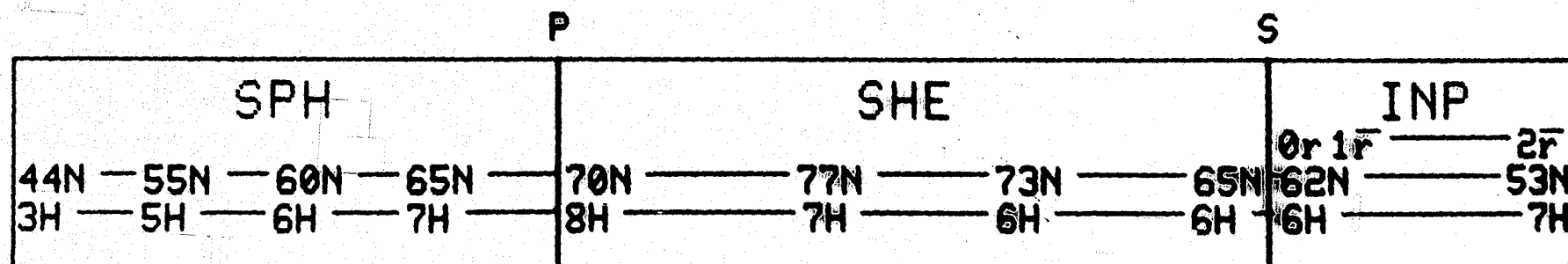
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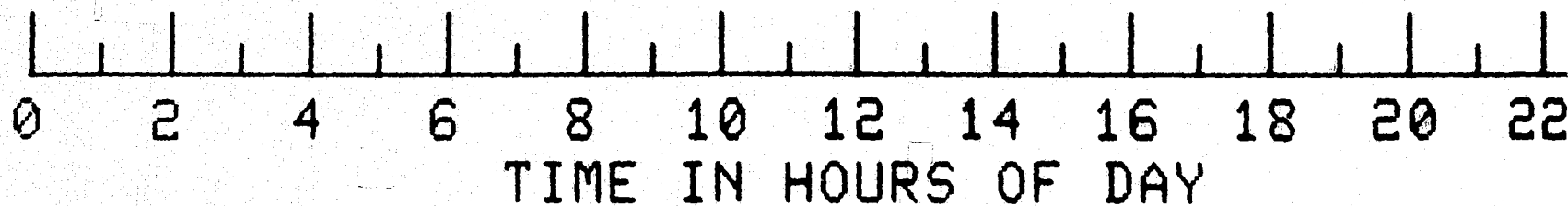
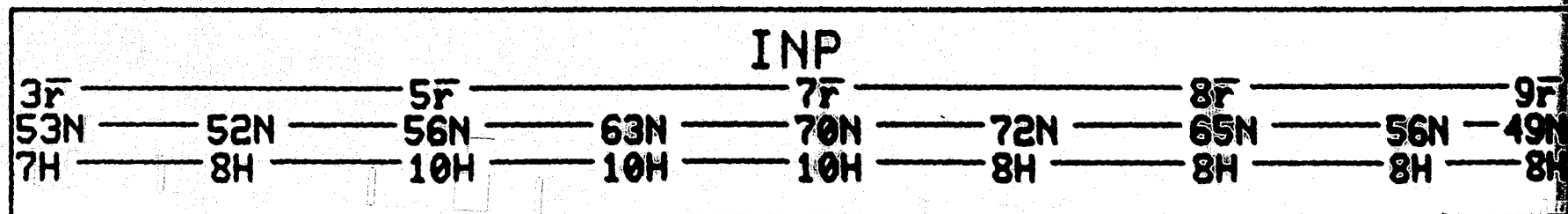
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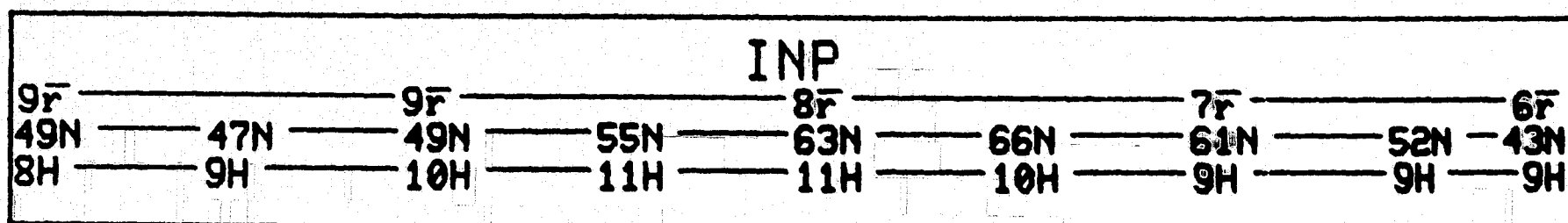
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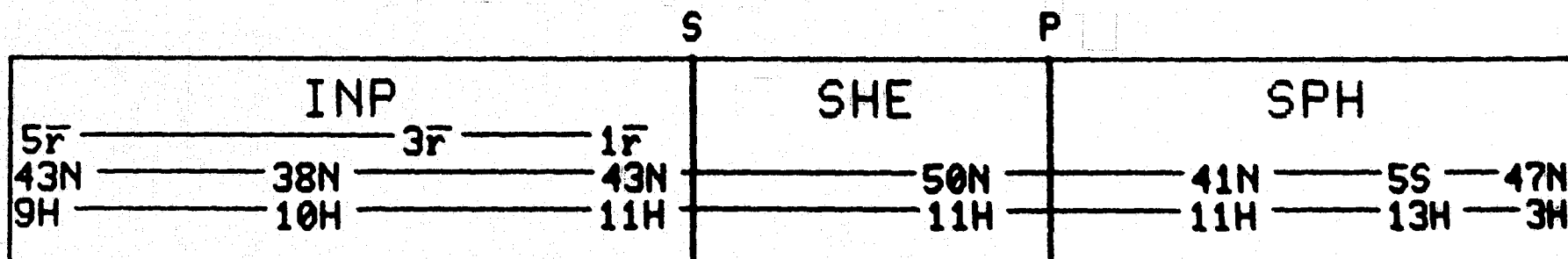
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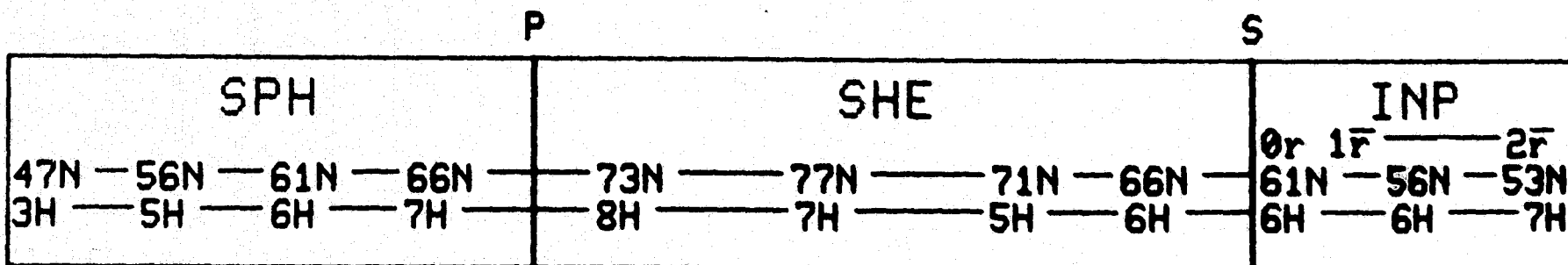
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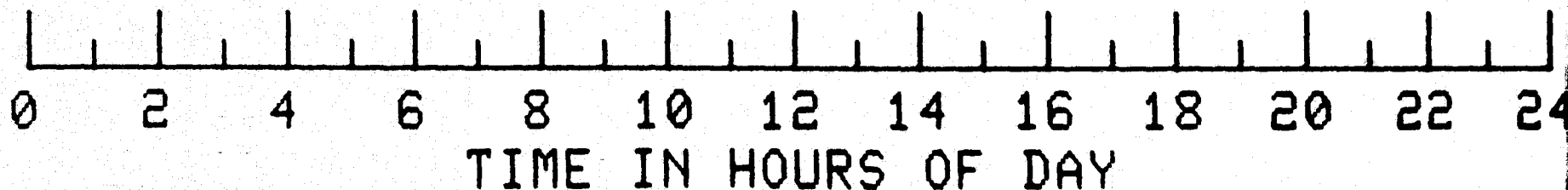
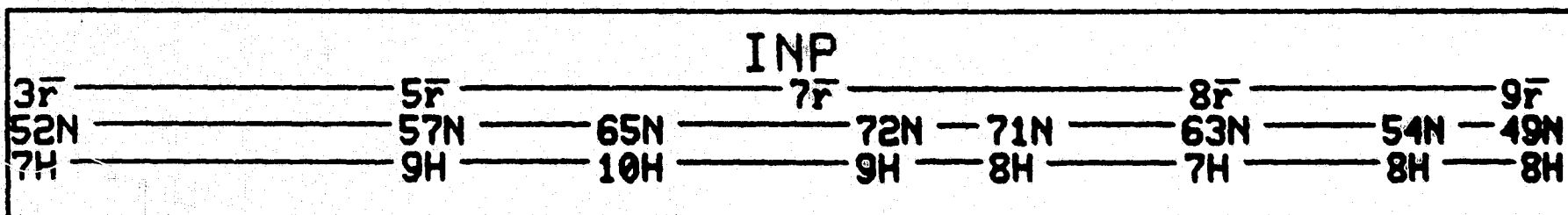
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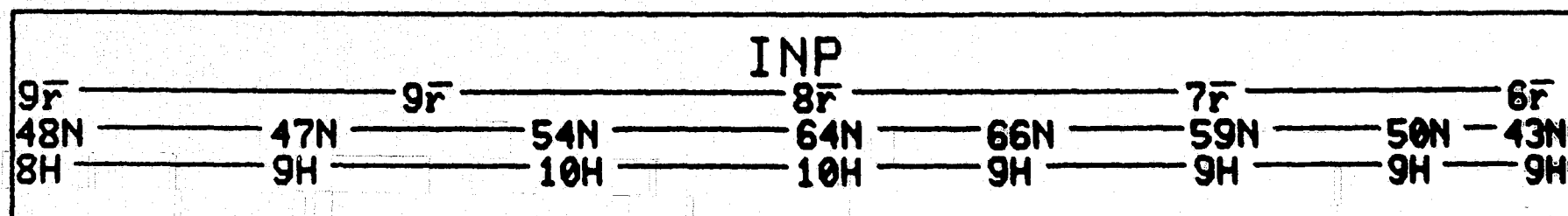
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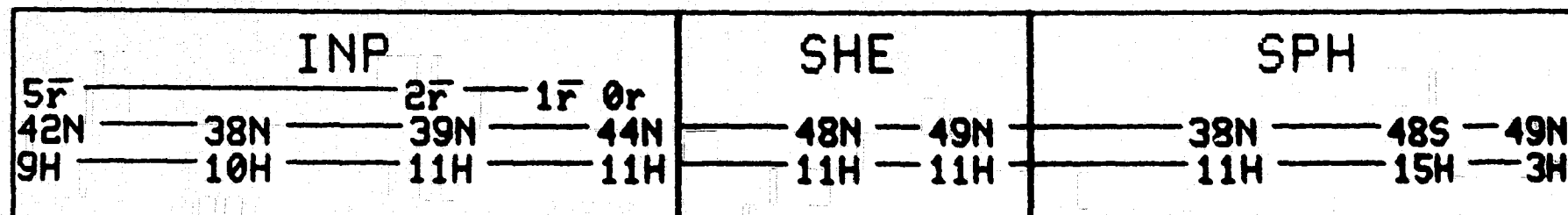
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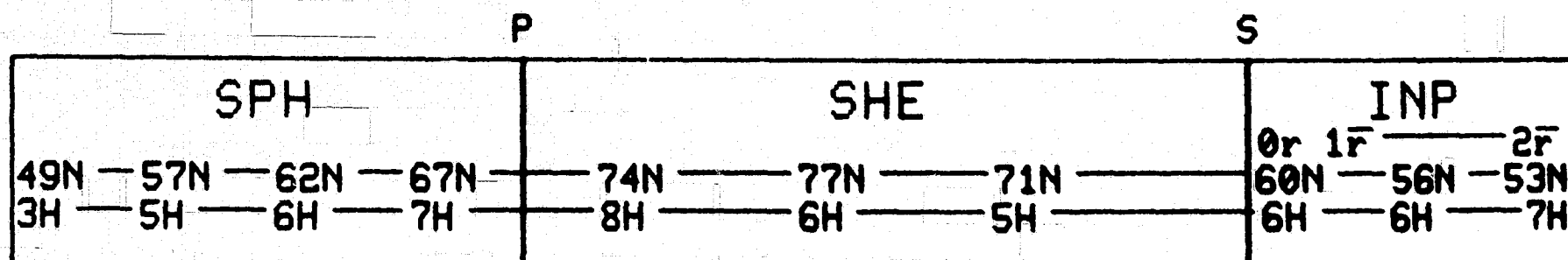
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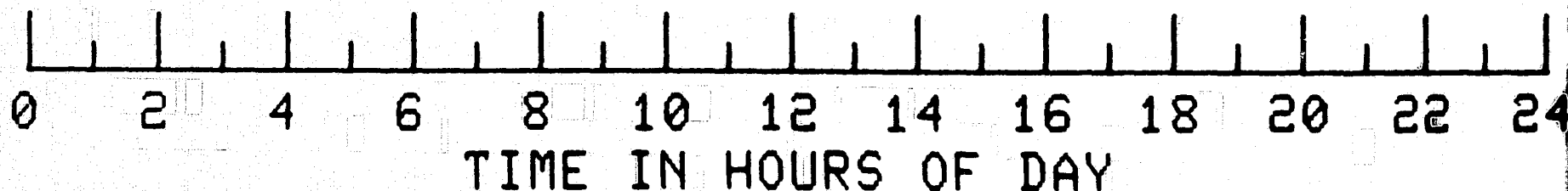
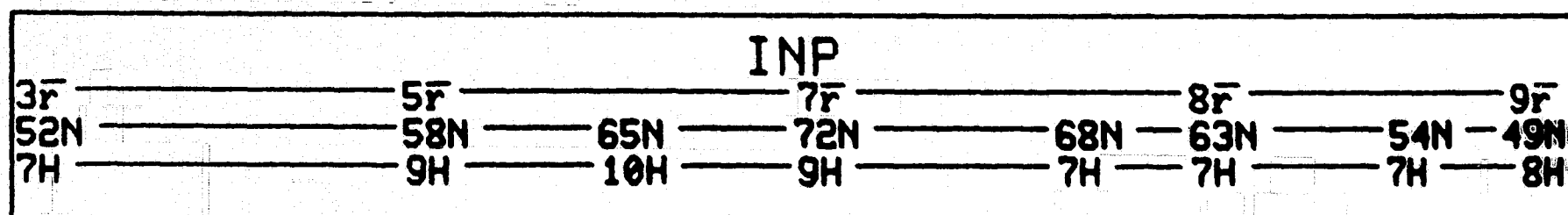
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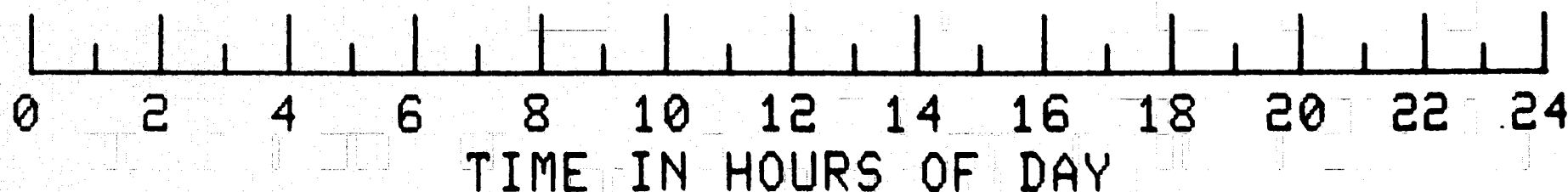
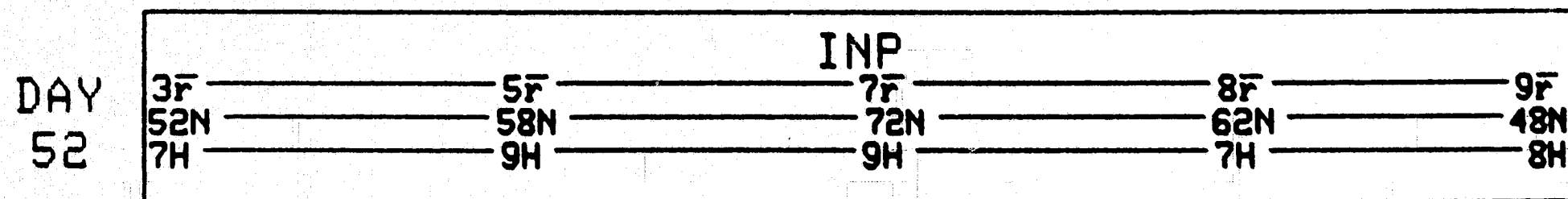
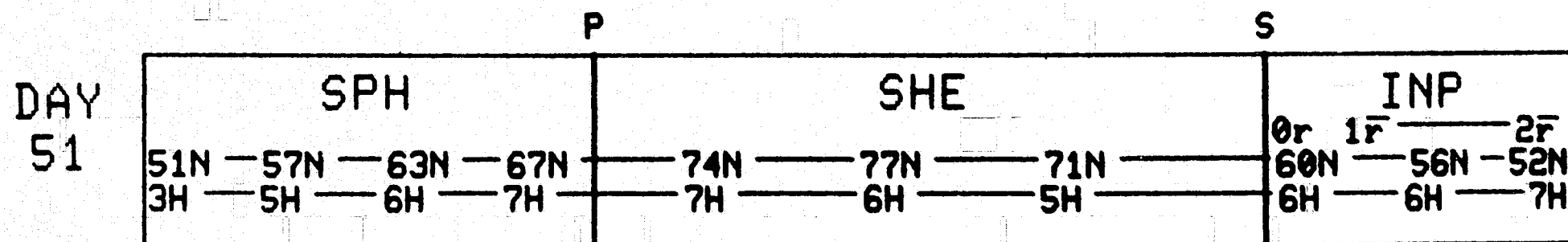
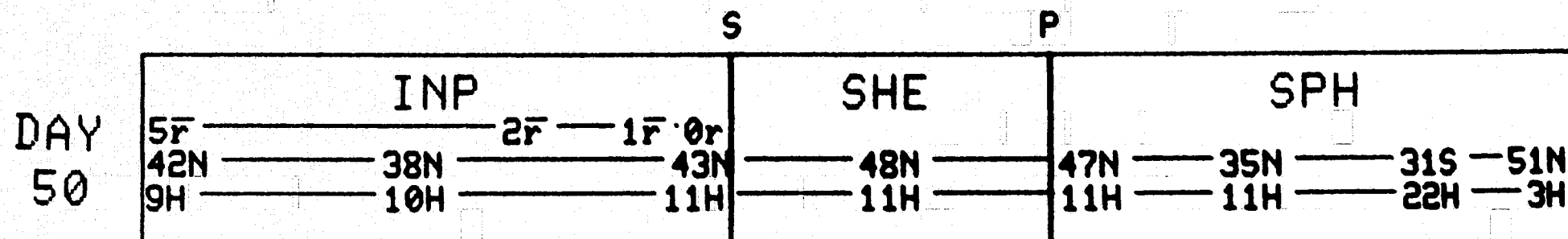
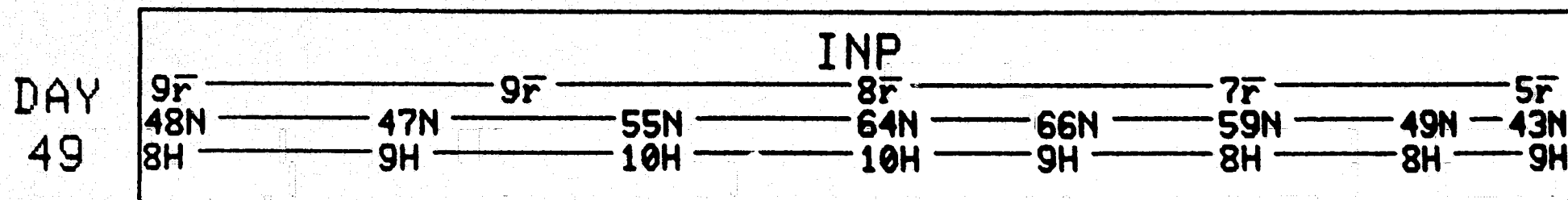


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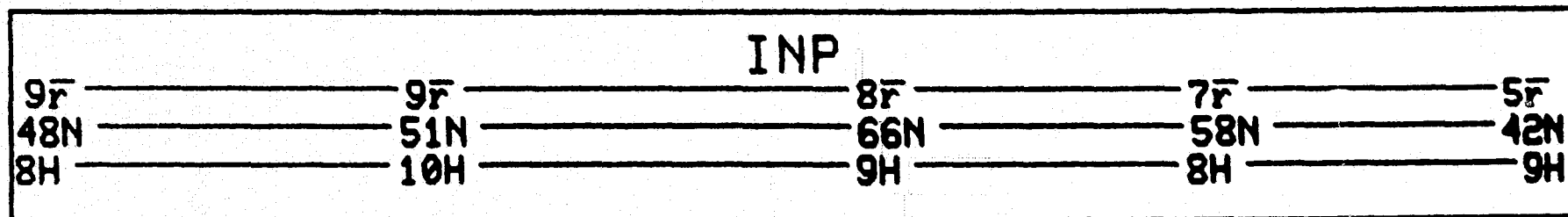


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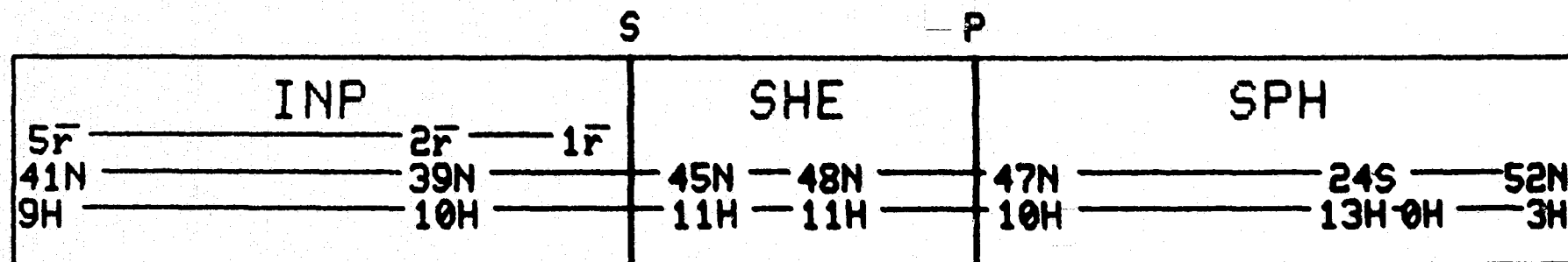




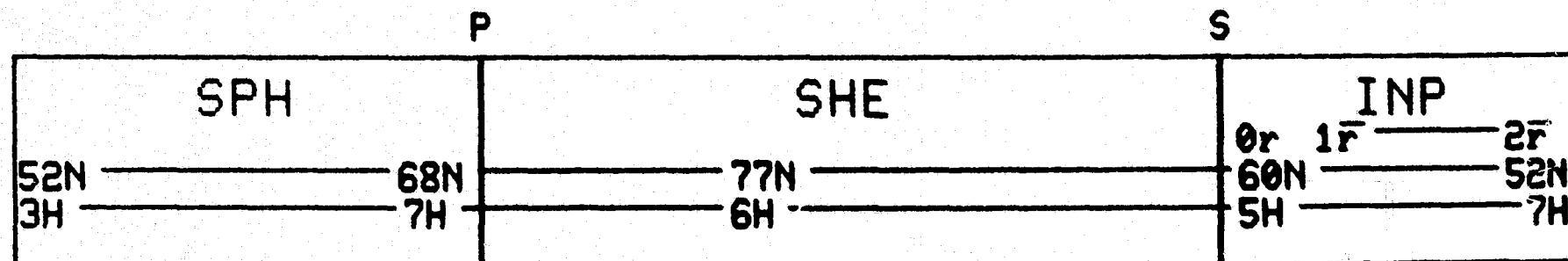
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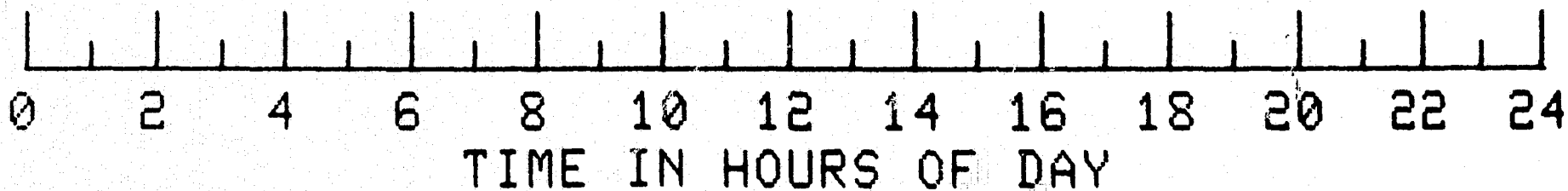
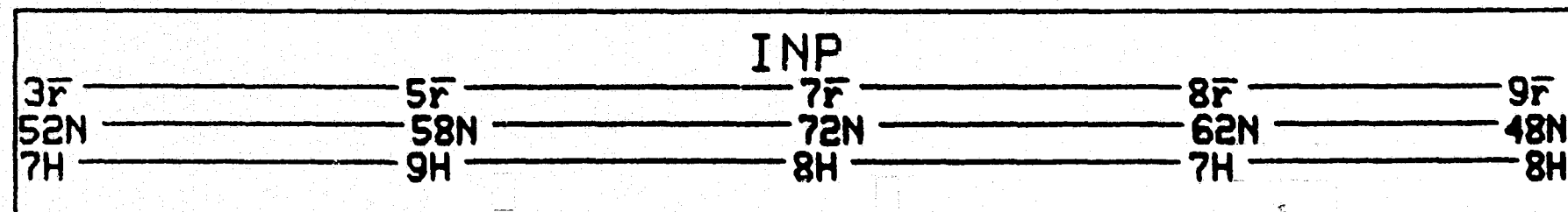
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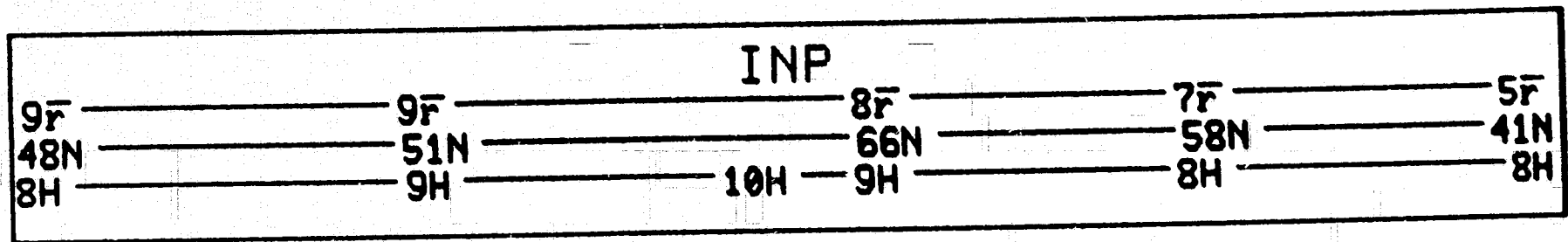
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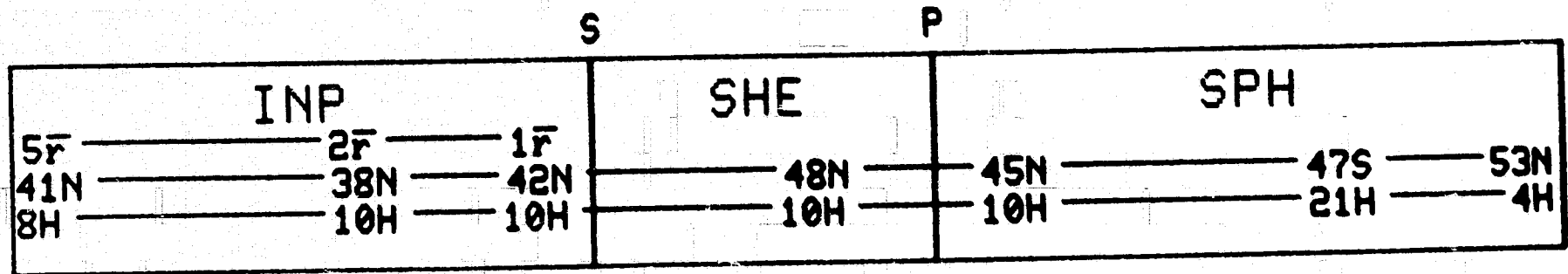
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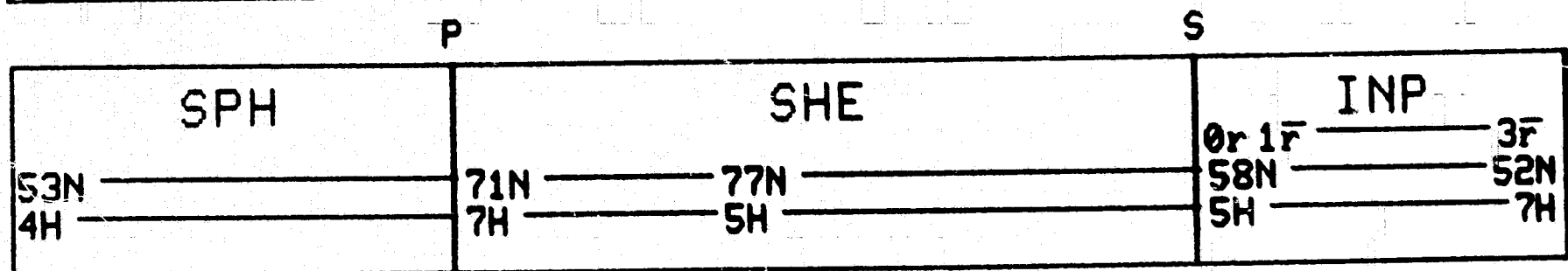
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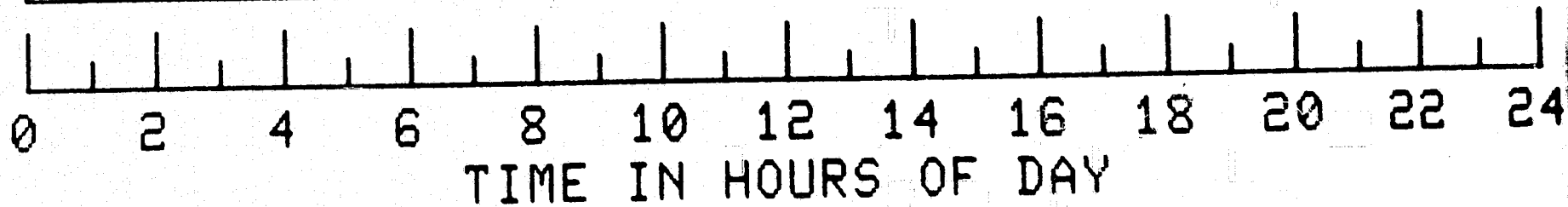
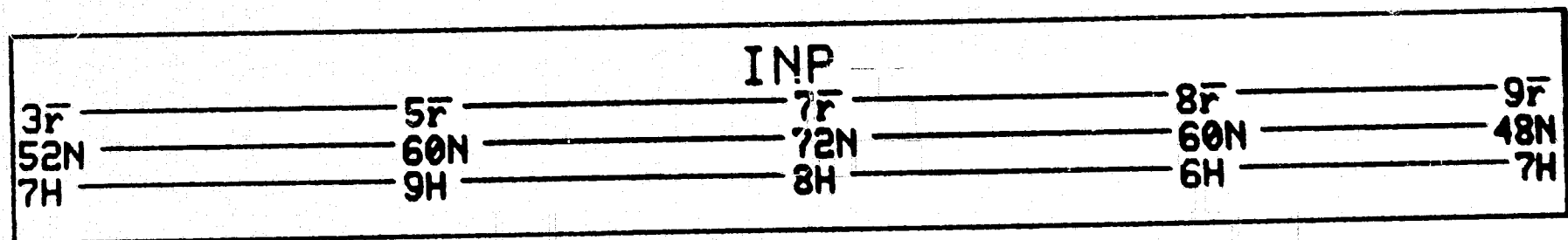
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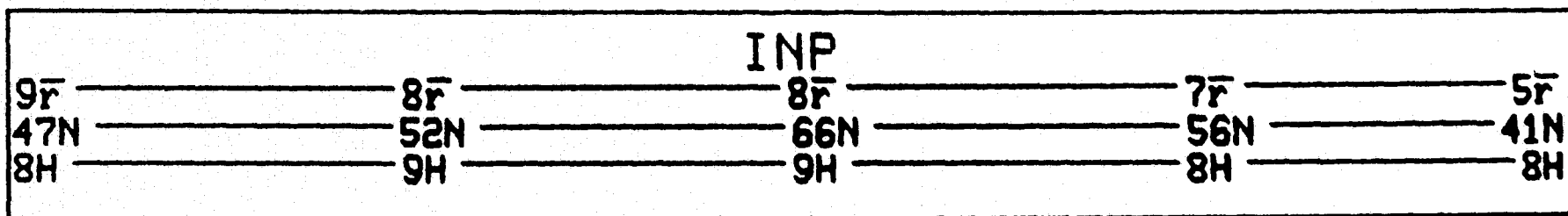
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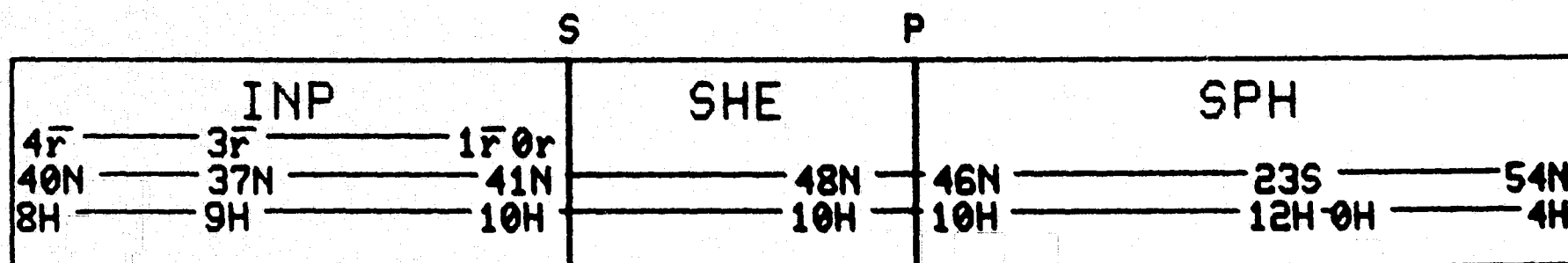
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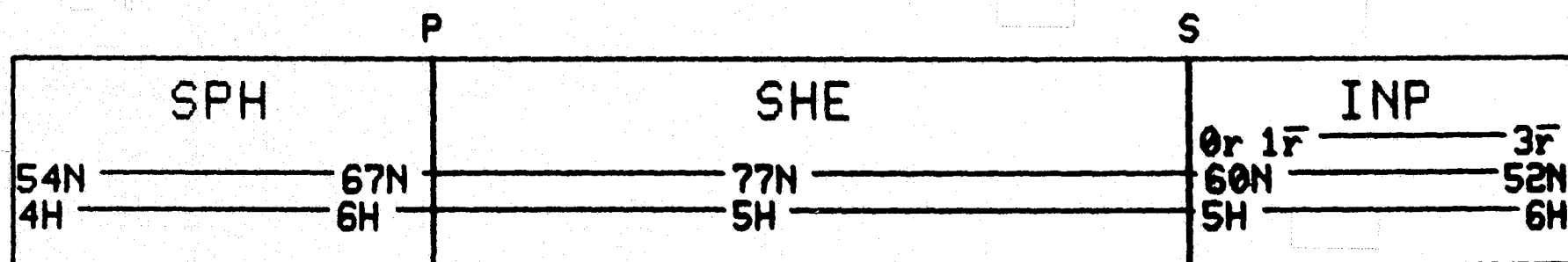
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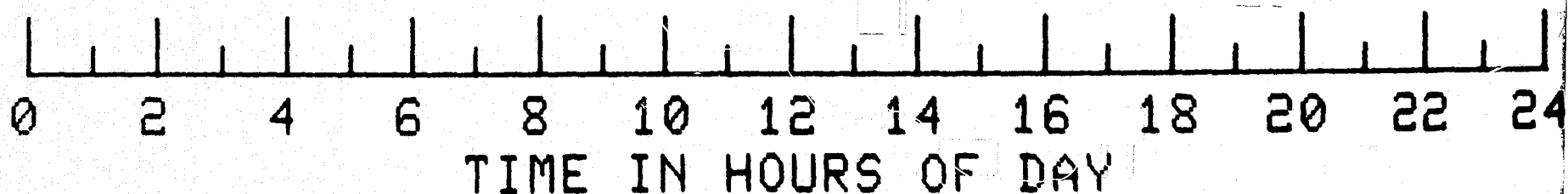
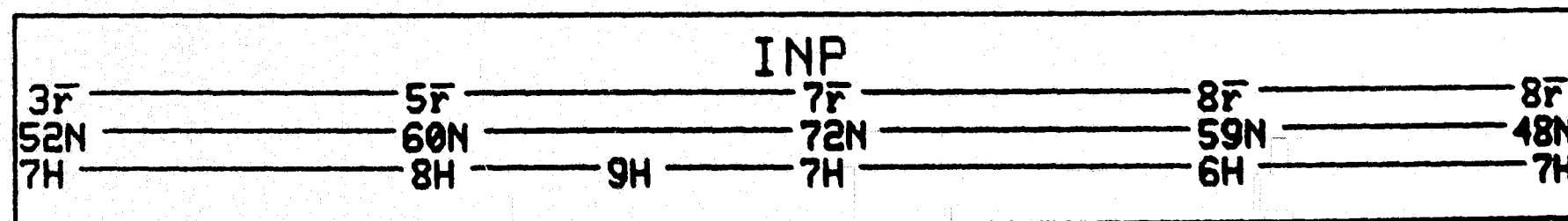
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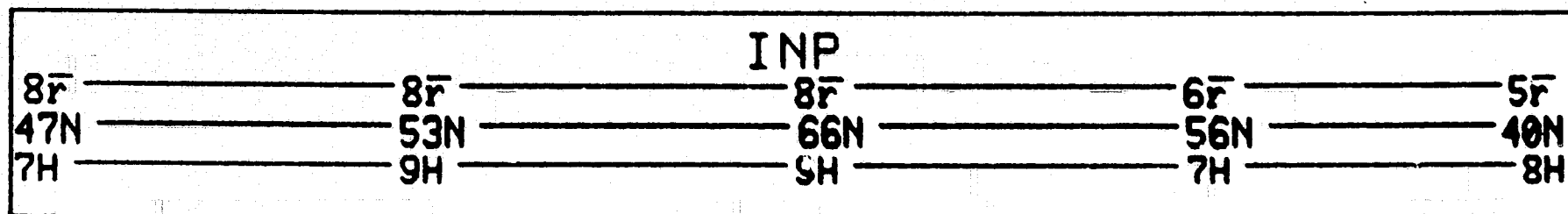
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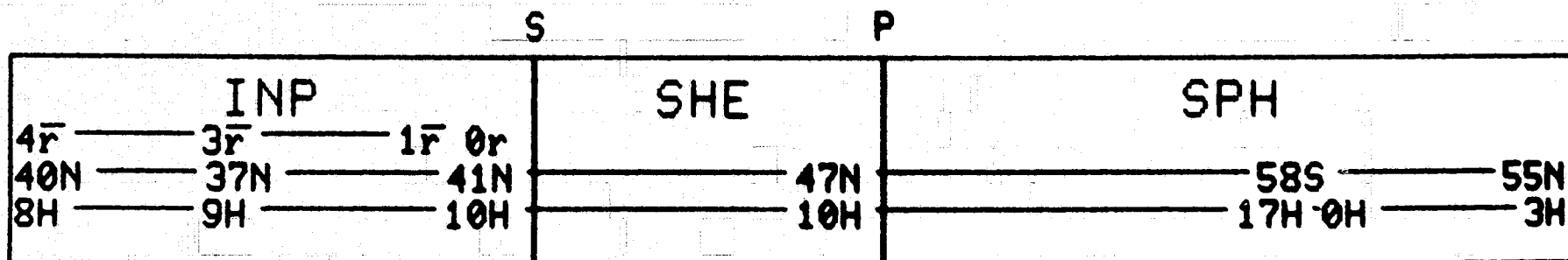
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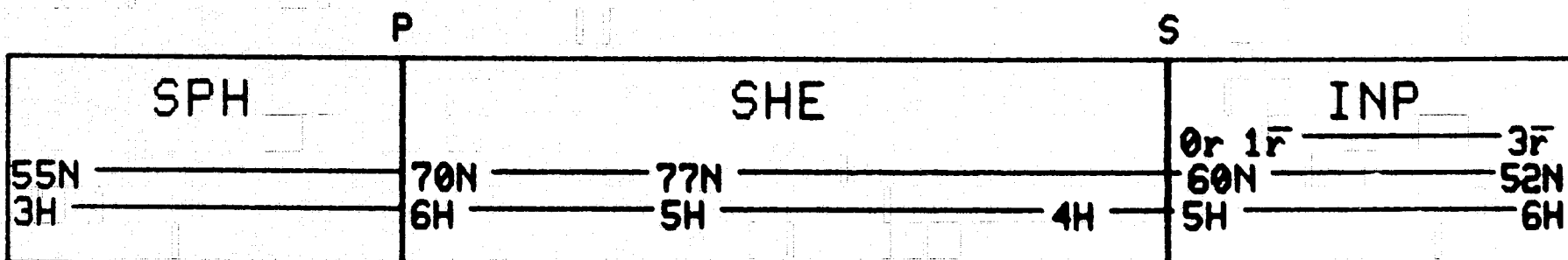
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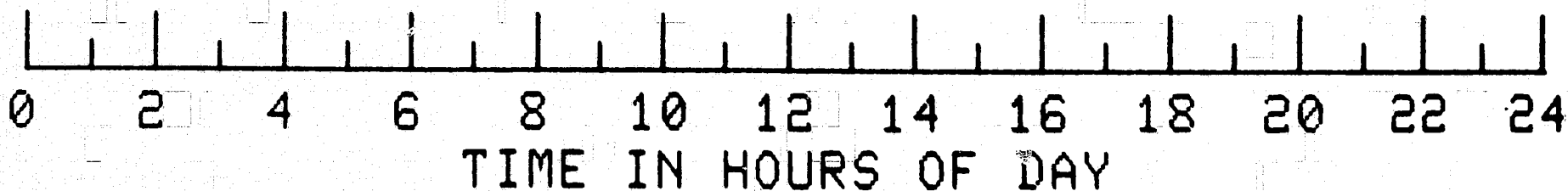
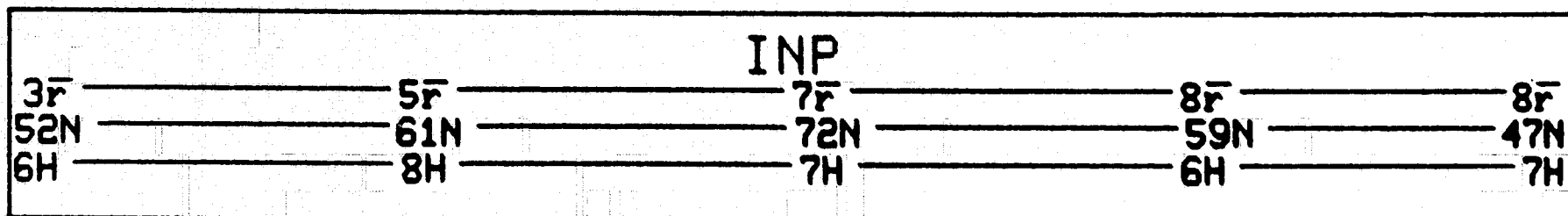
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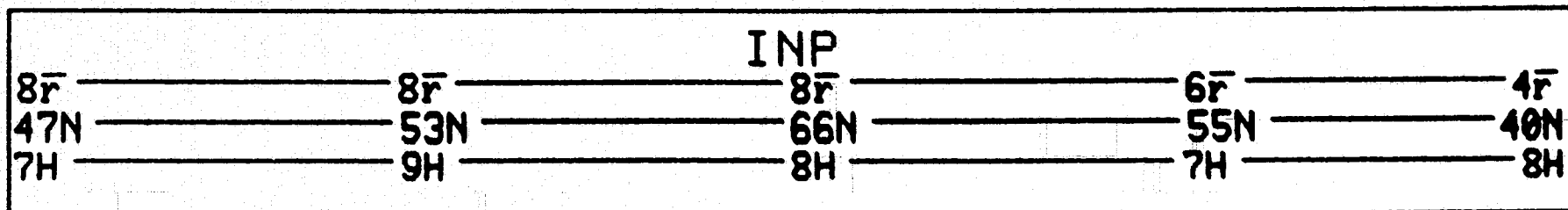
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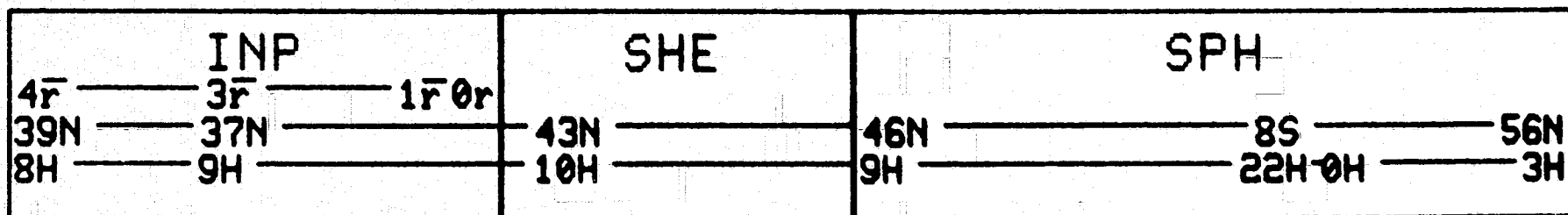
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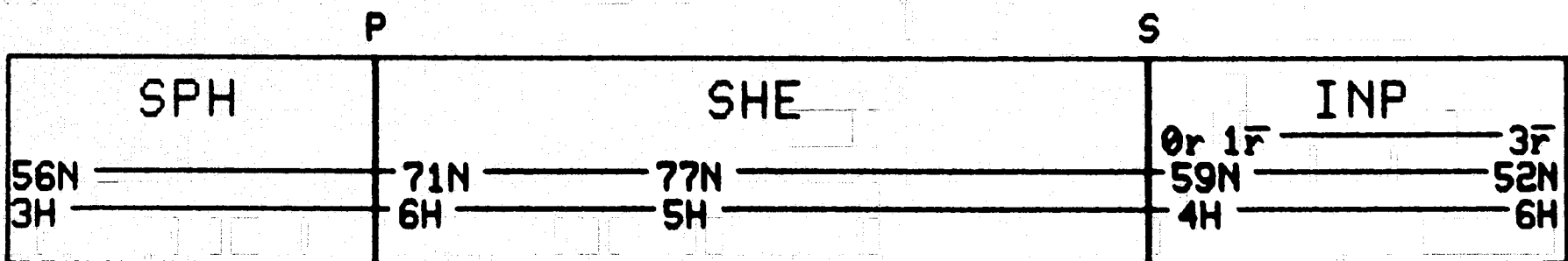
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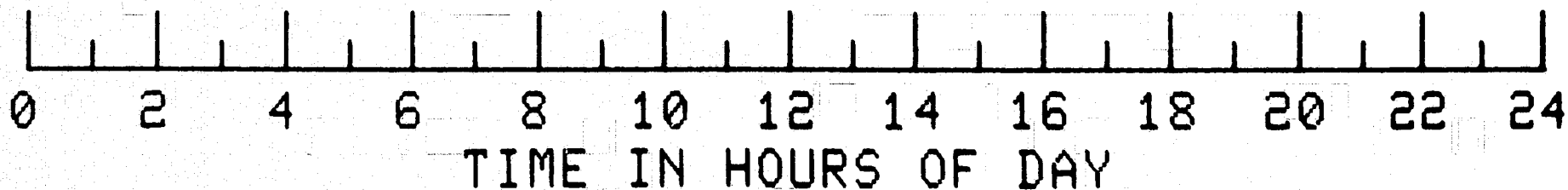
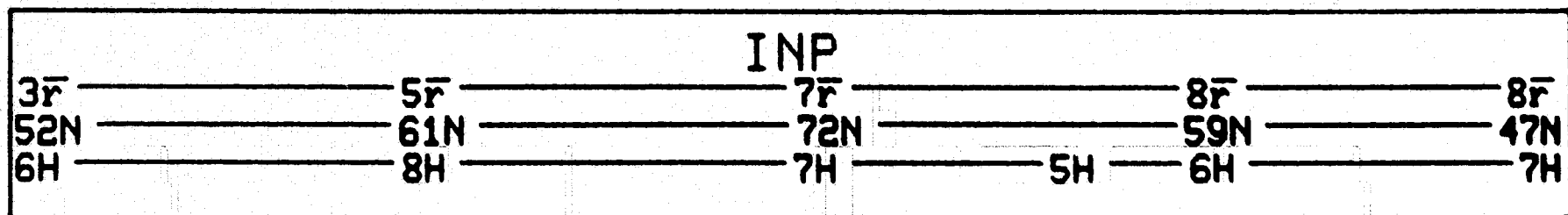
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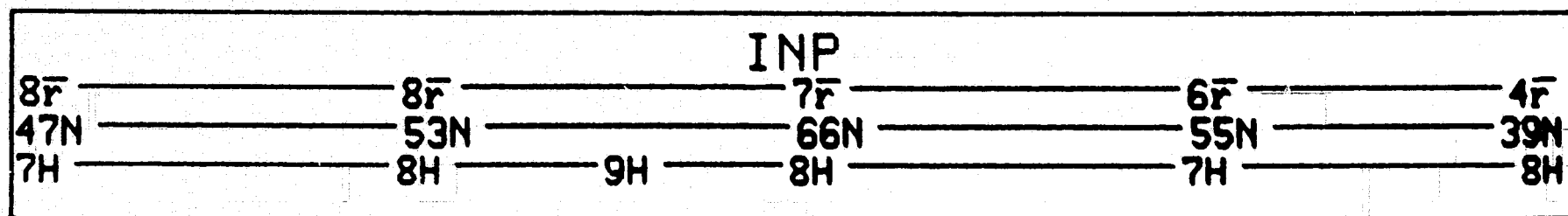
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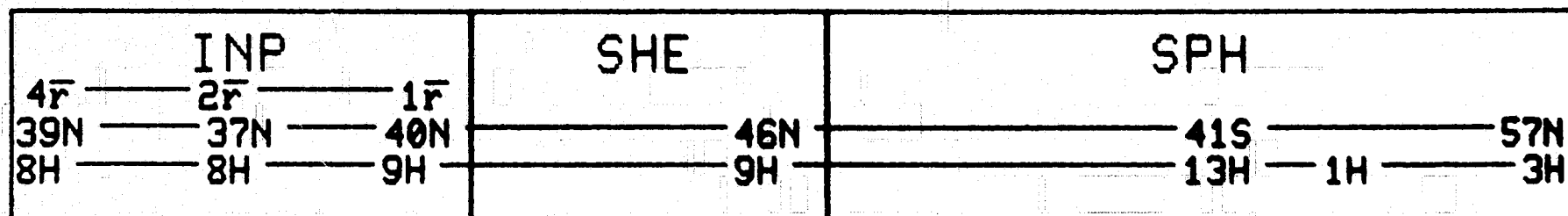
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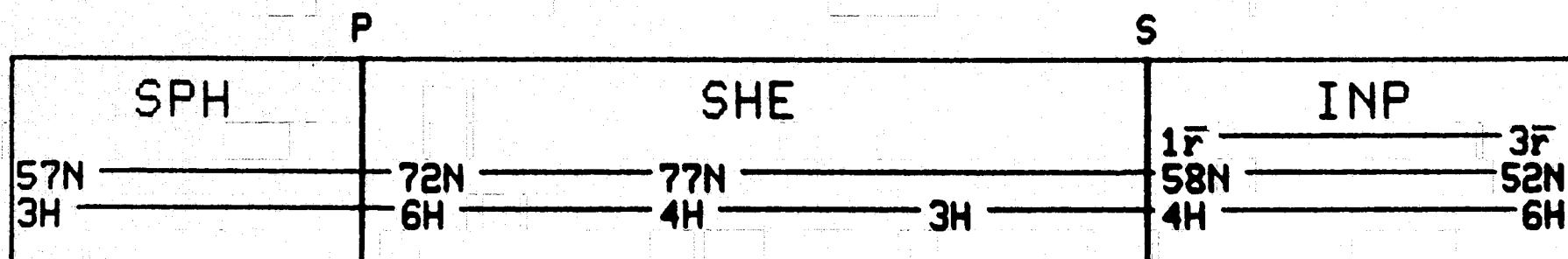
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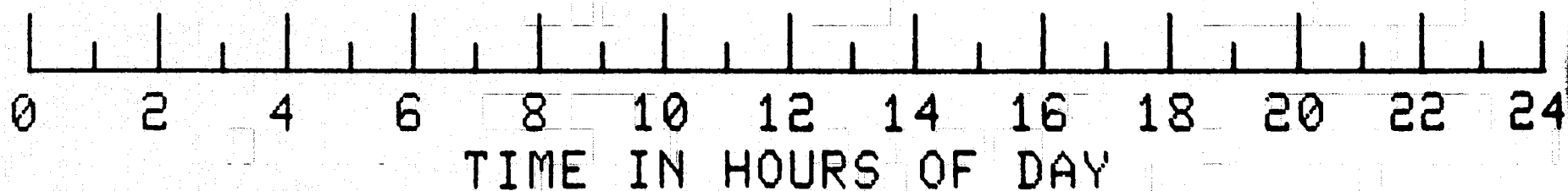
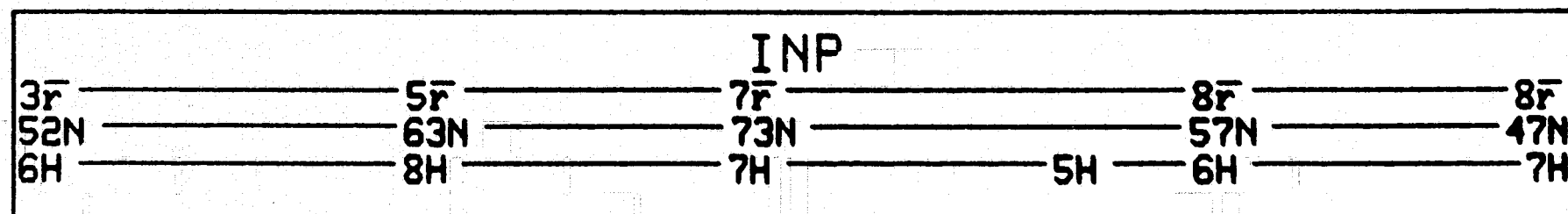
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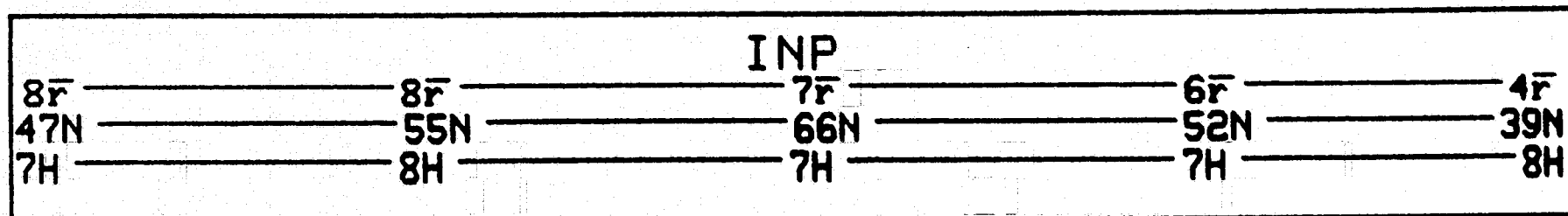
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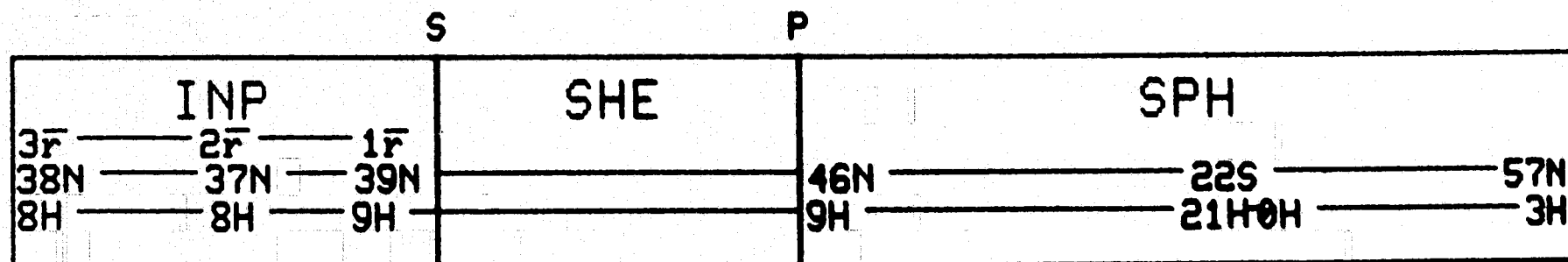
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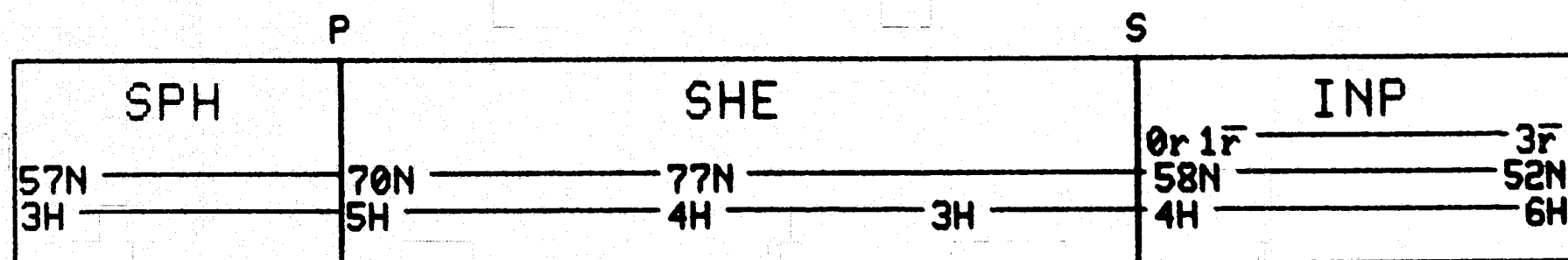
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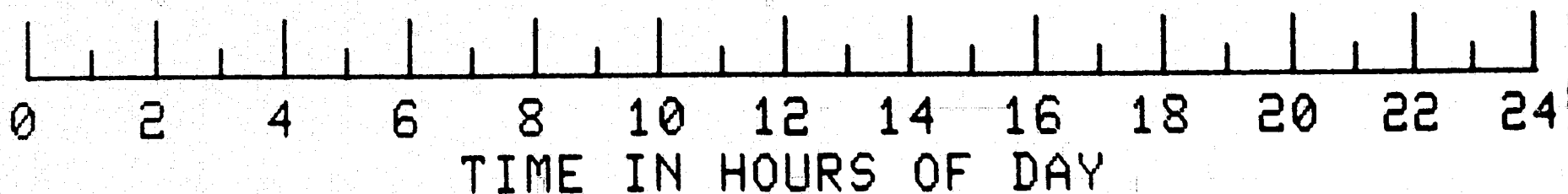
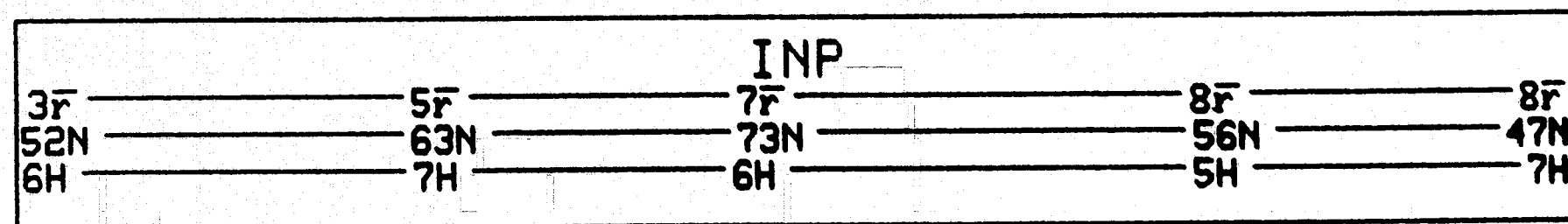
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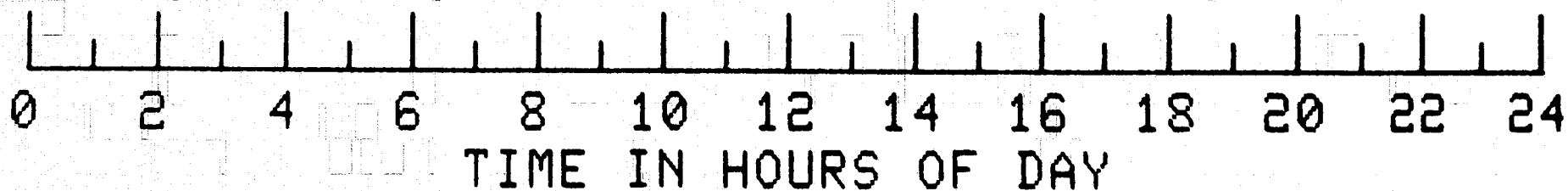
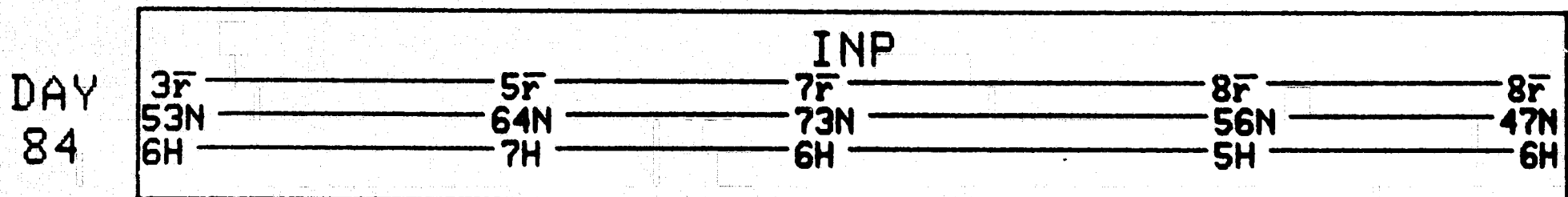
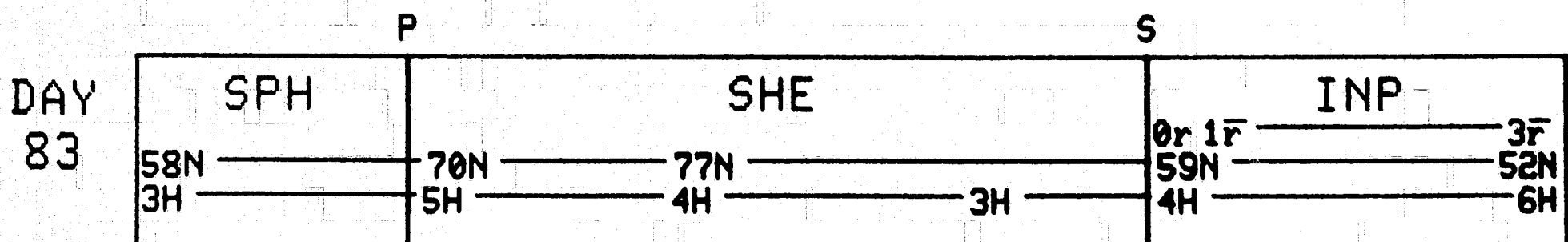
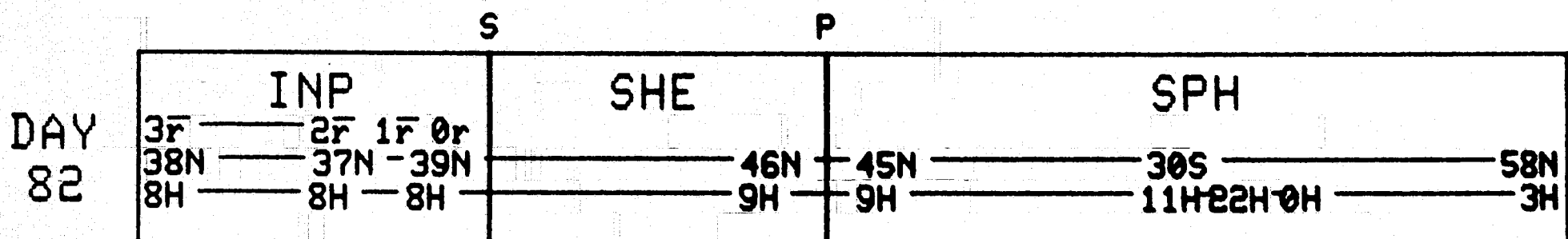
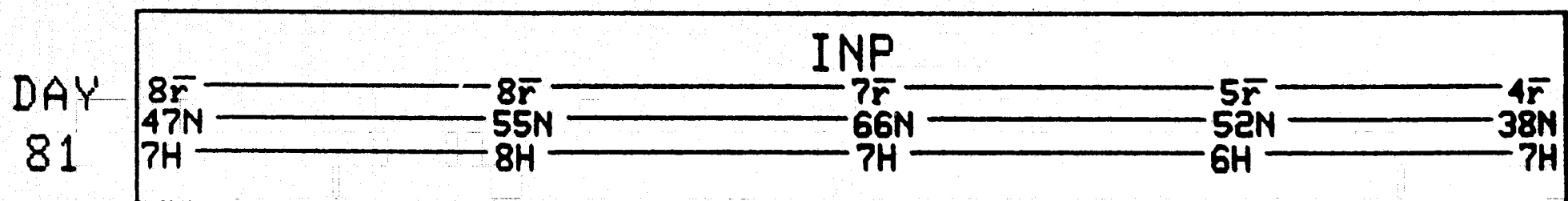


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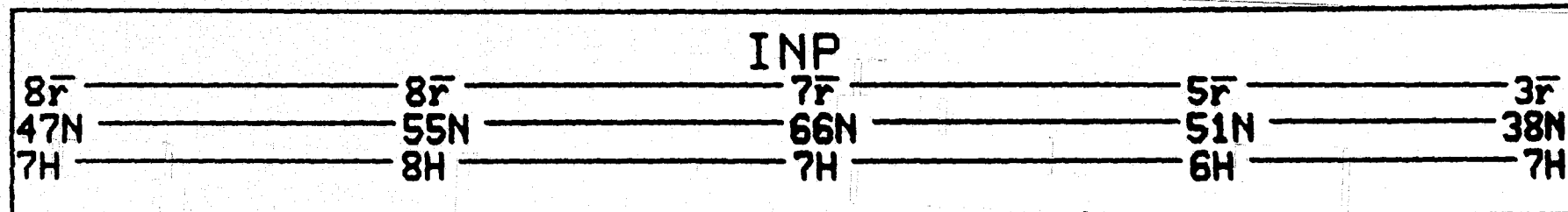


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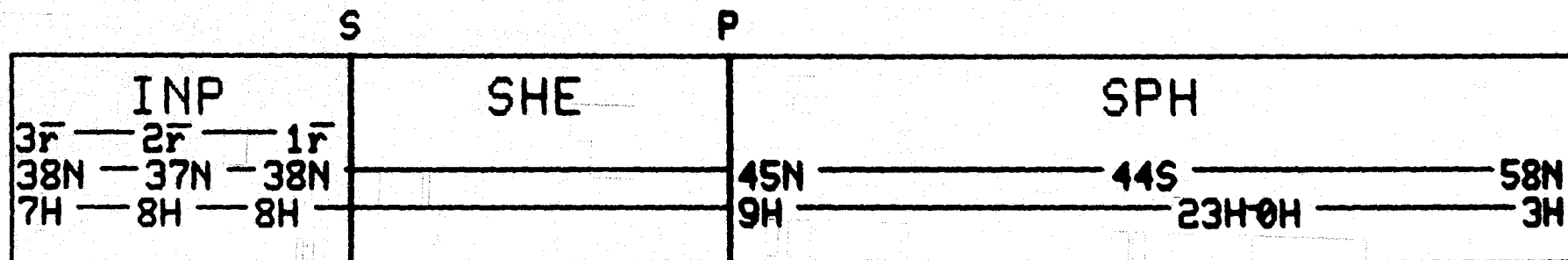




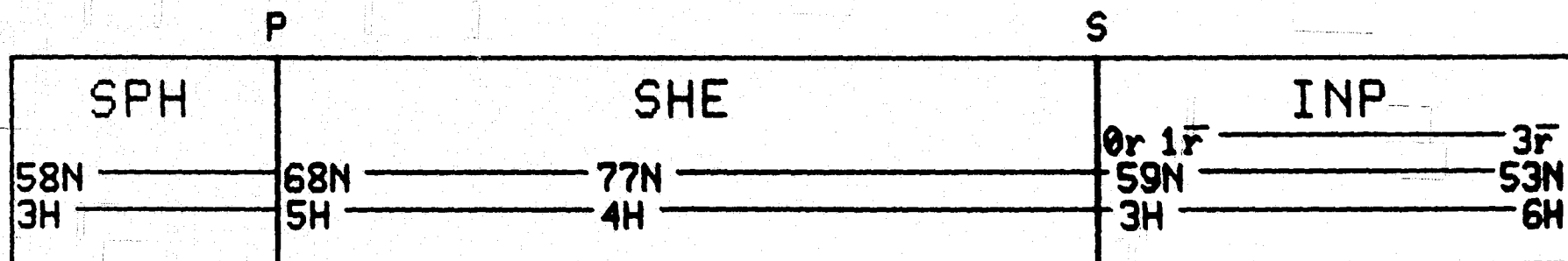
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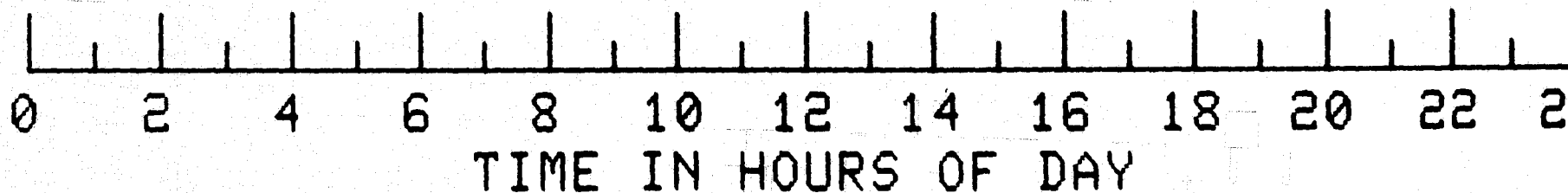
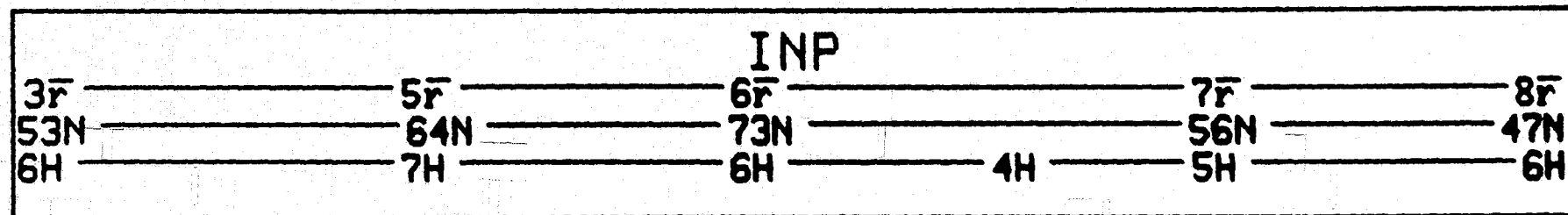
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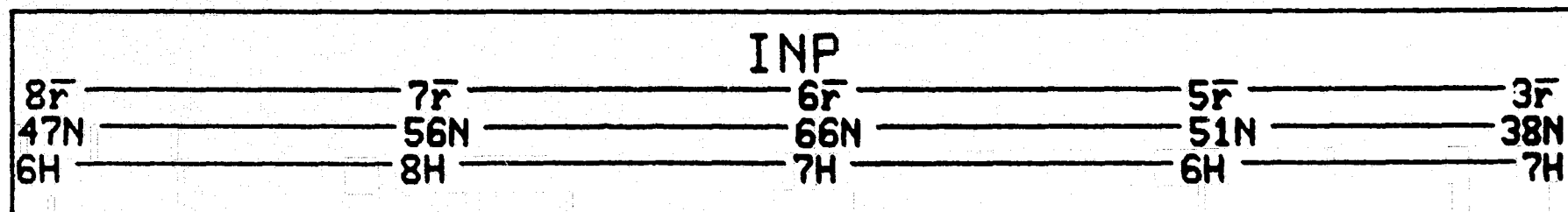
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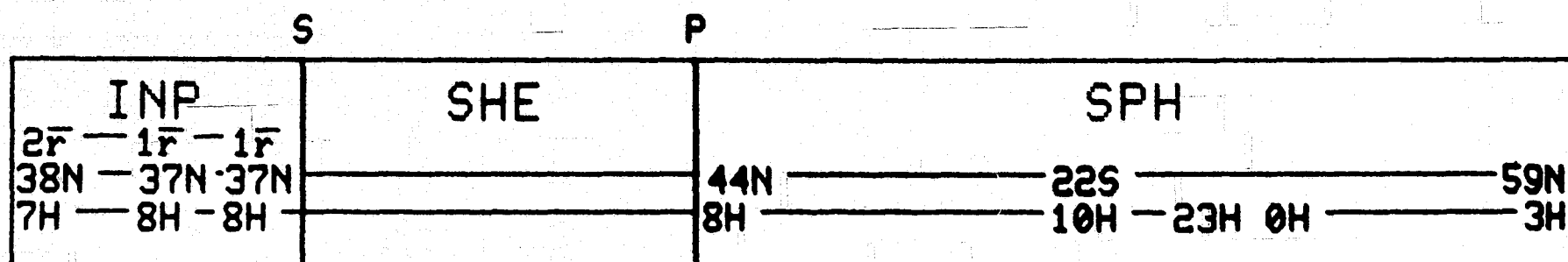
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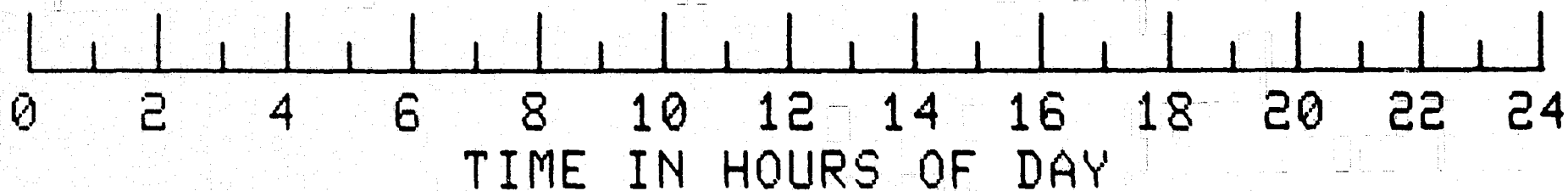
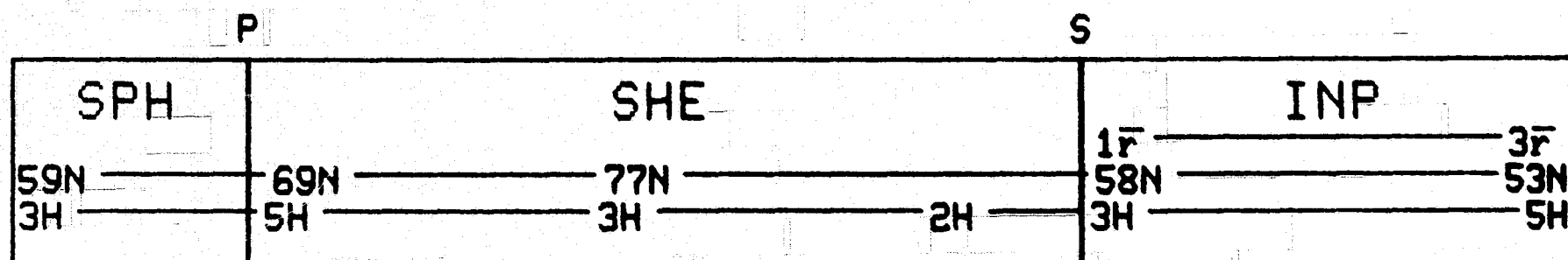
DAY
89



DAY
90



DAY
91

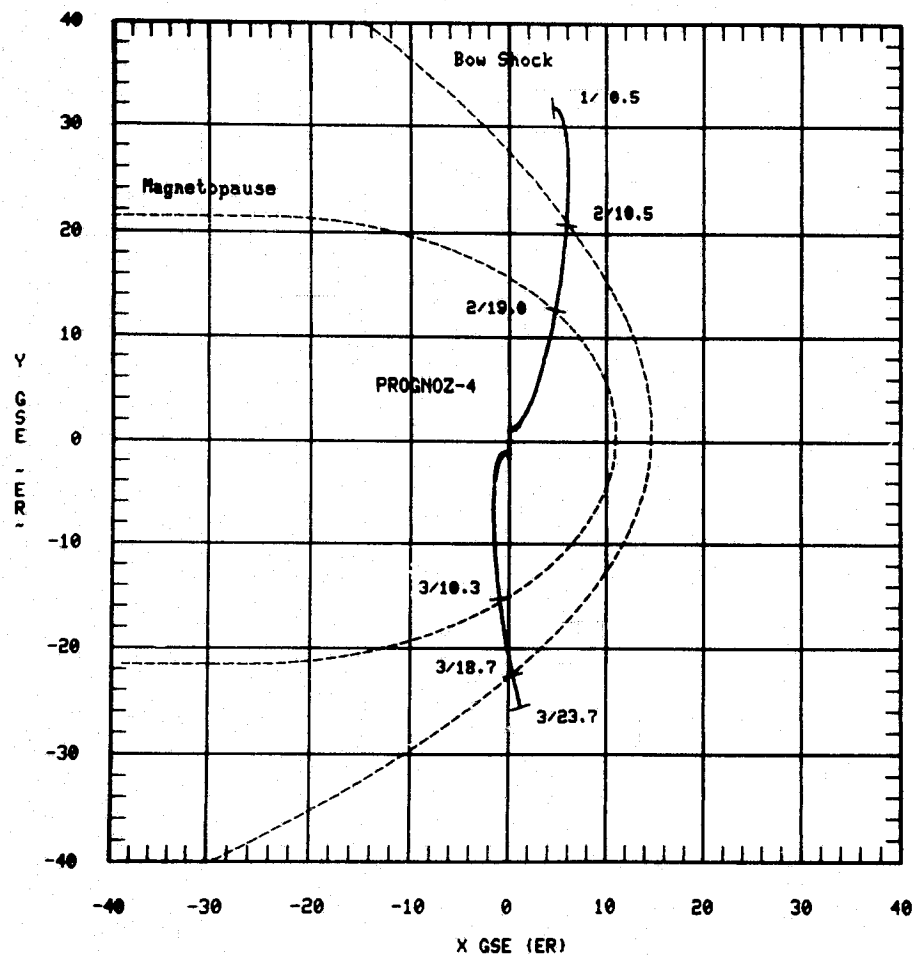


APPENDIX B

GEOCENTRIC SOLAR ECLIPTIC PLOTS

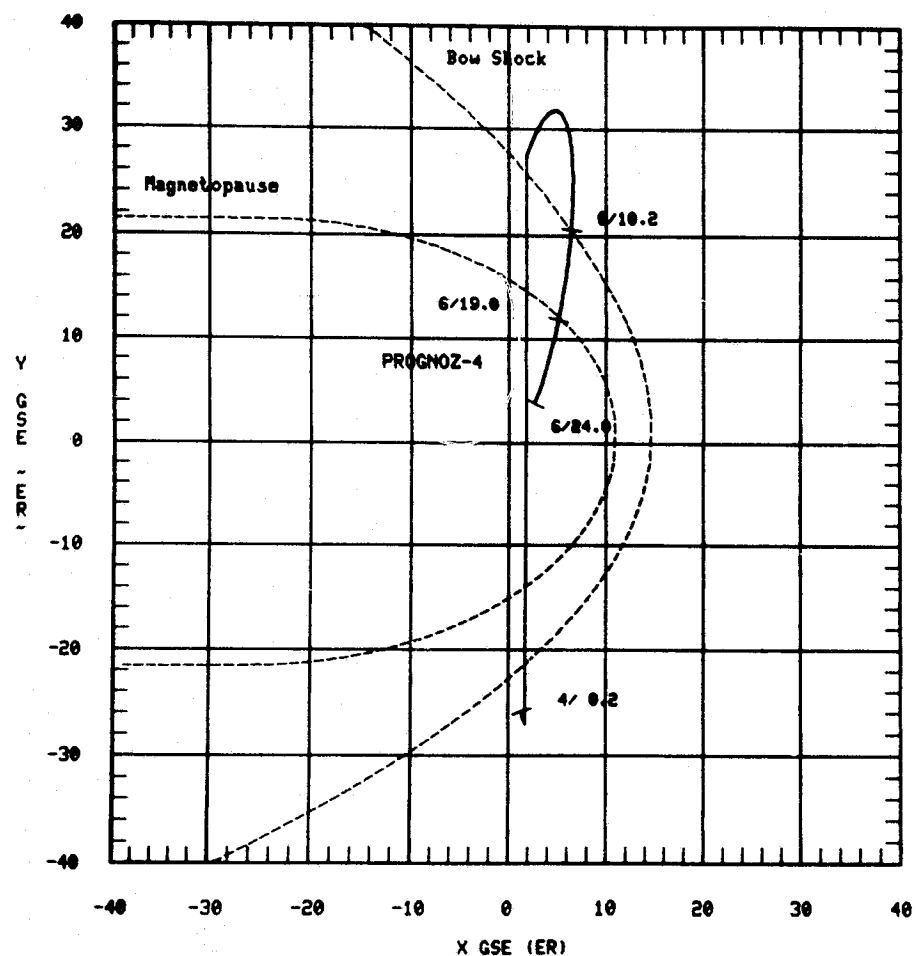


GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



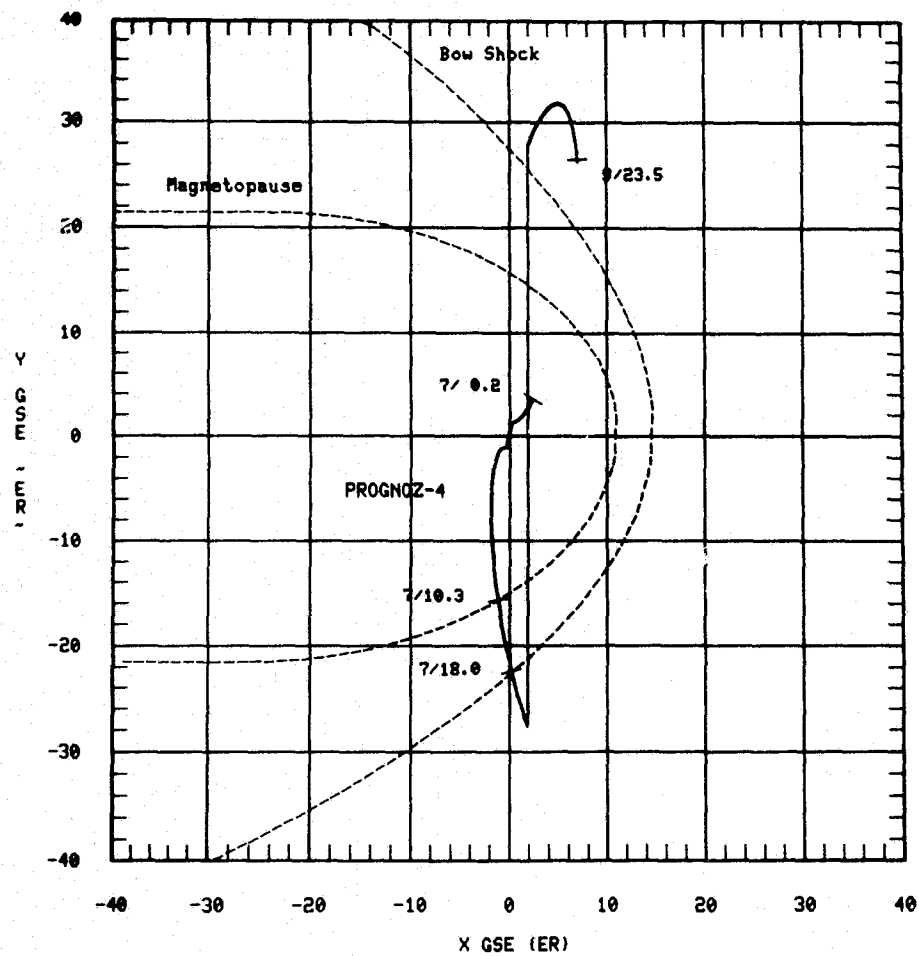
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GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



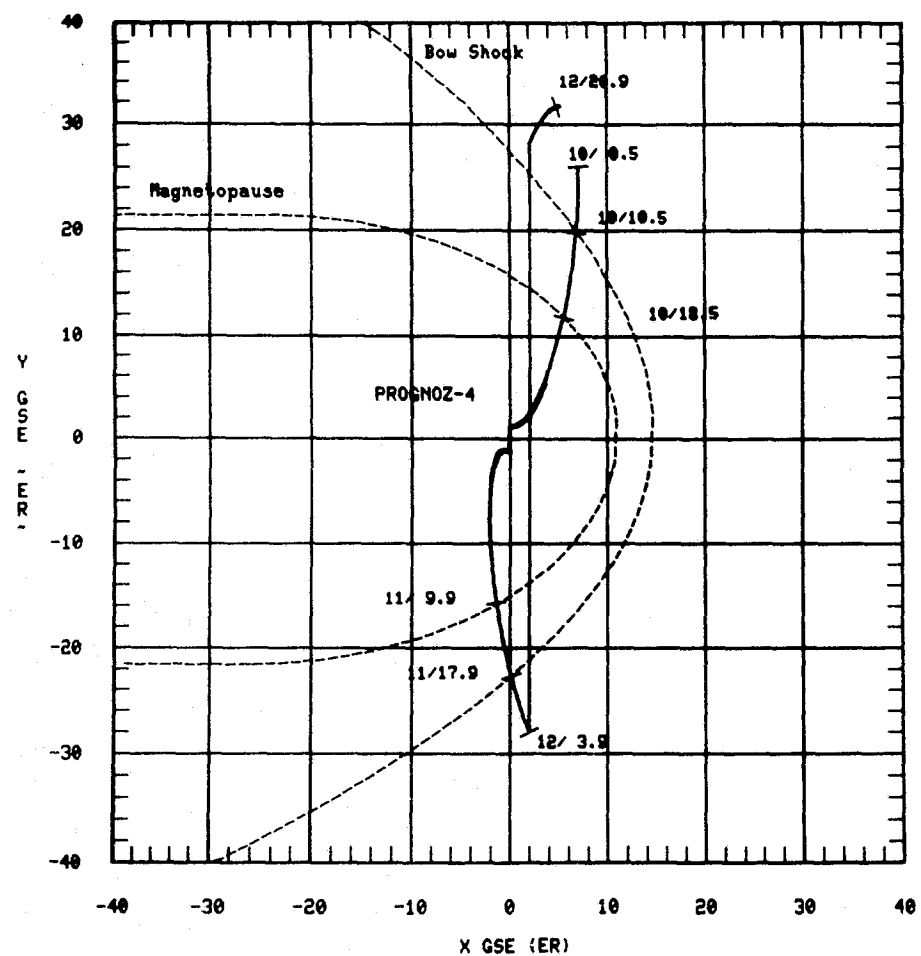
START TIME = 1976/ 4/ 0.2 STOP TIME = 1976/ 6/24.0

GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



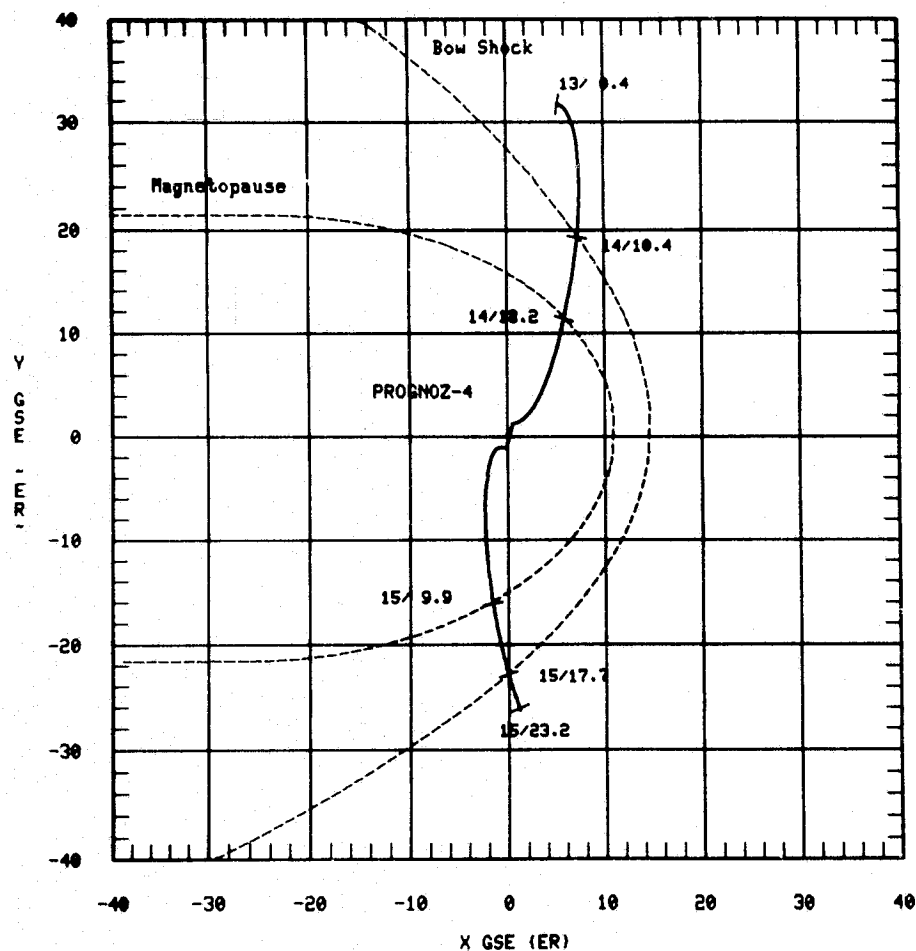
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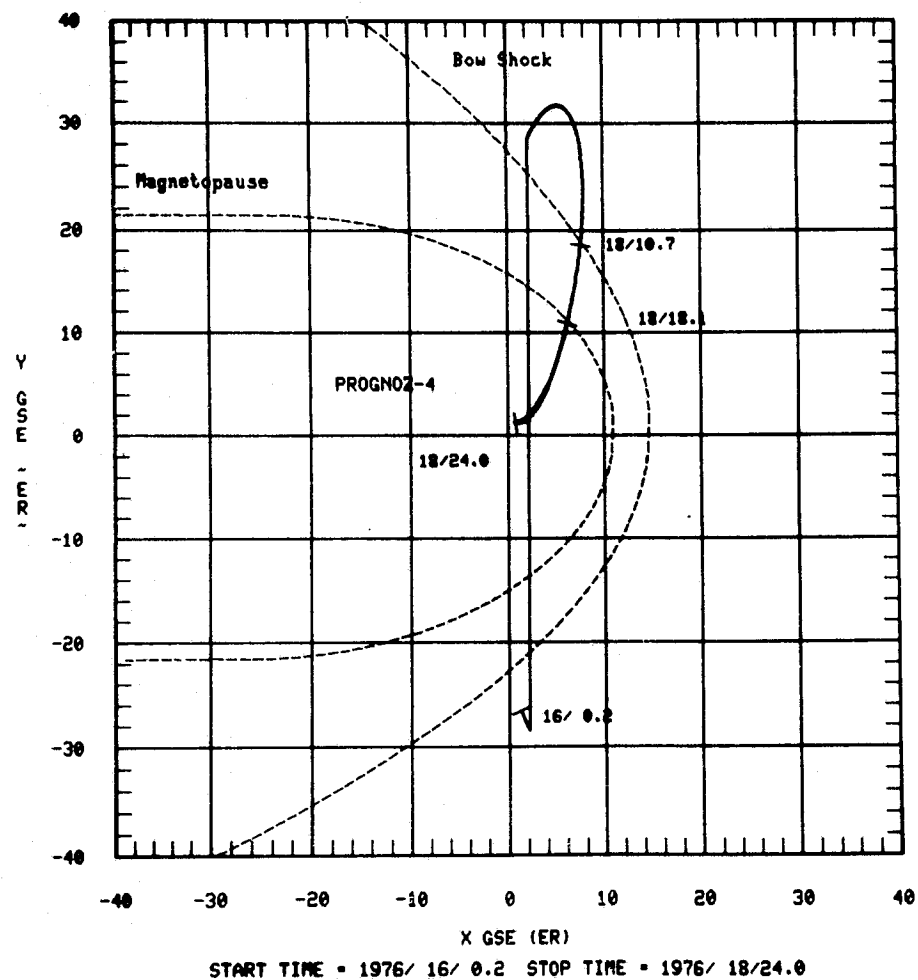


START TIME = 1976/ 10/ 0.5 STOP TIME = 1976/ 12/23.9

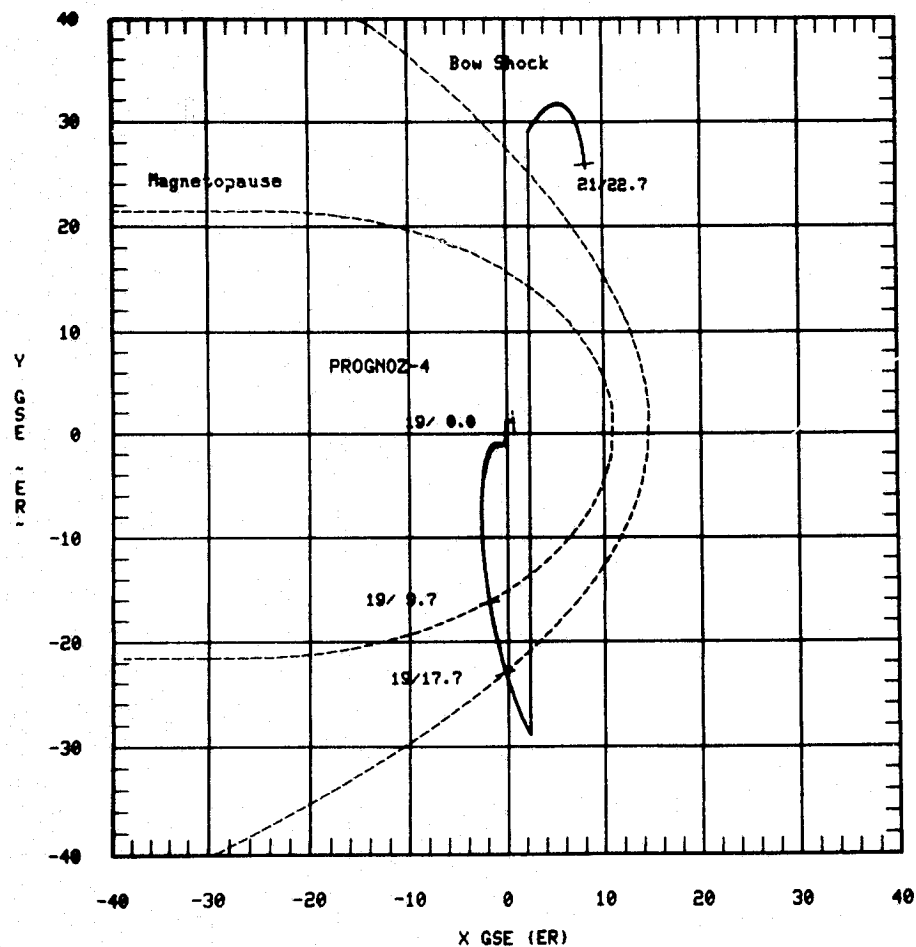
GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION

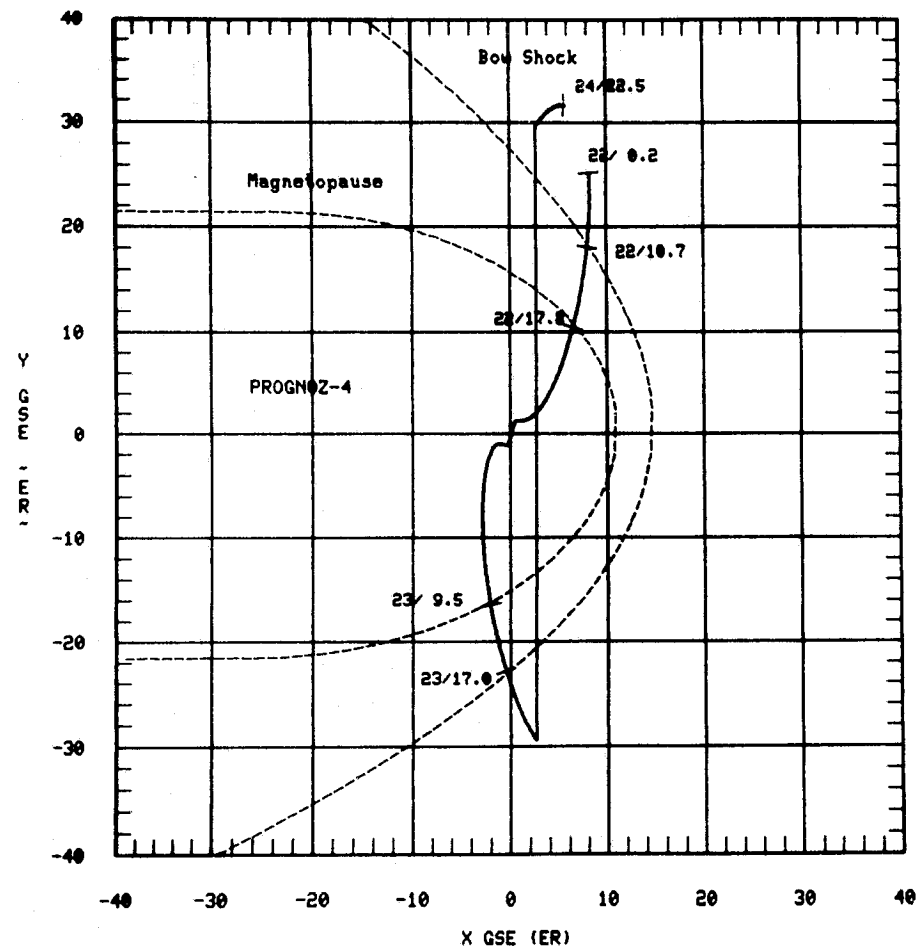


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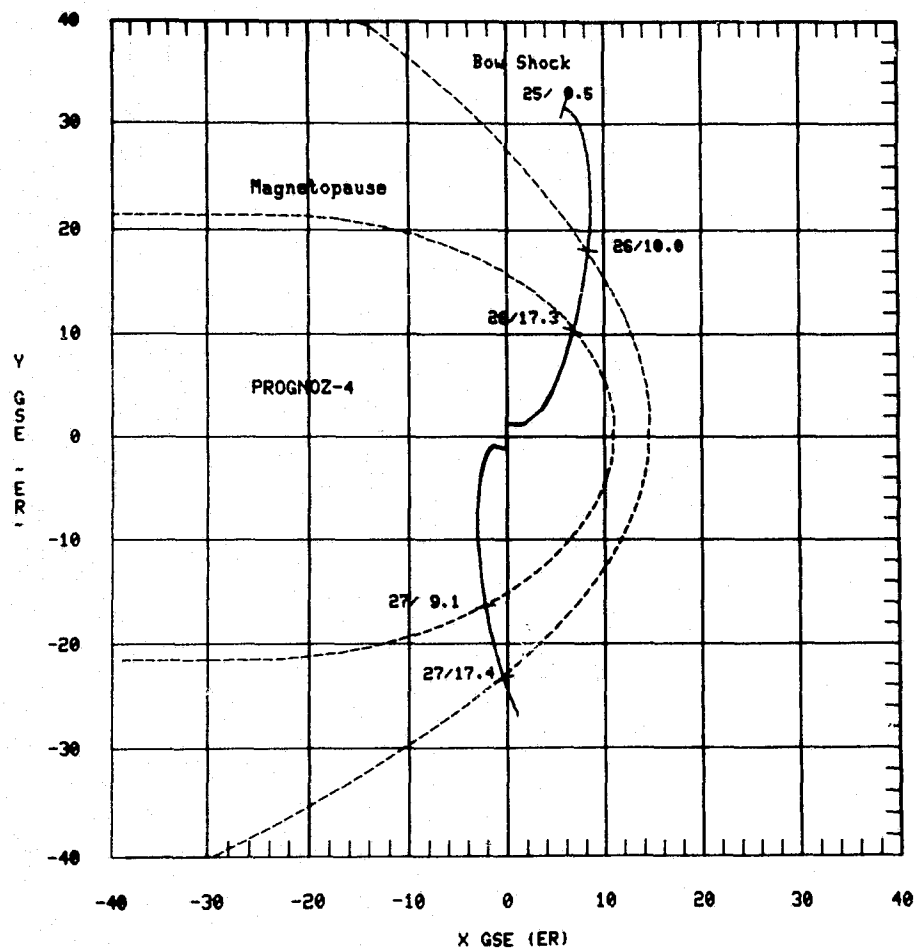
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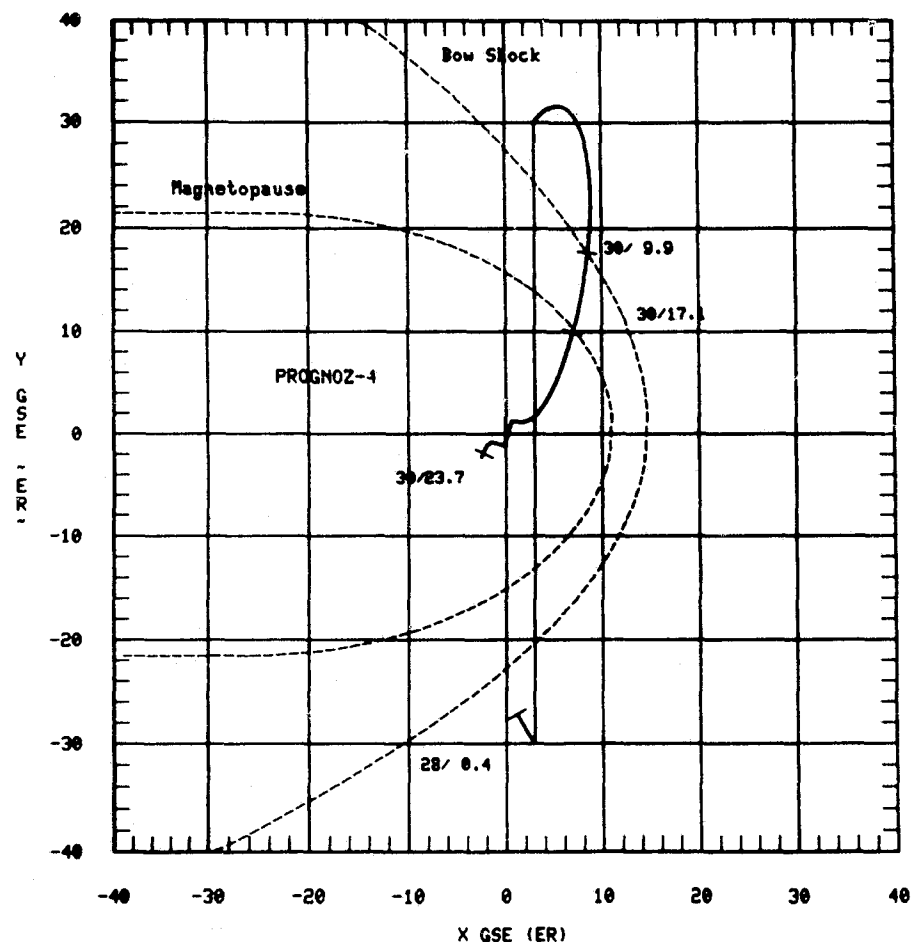
START TIME = 1976/ 22/ 0.2 STOP TIME = 1976/ 24/24.0

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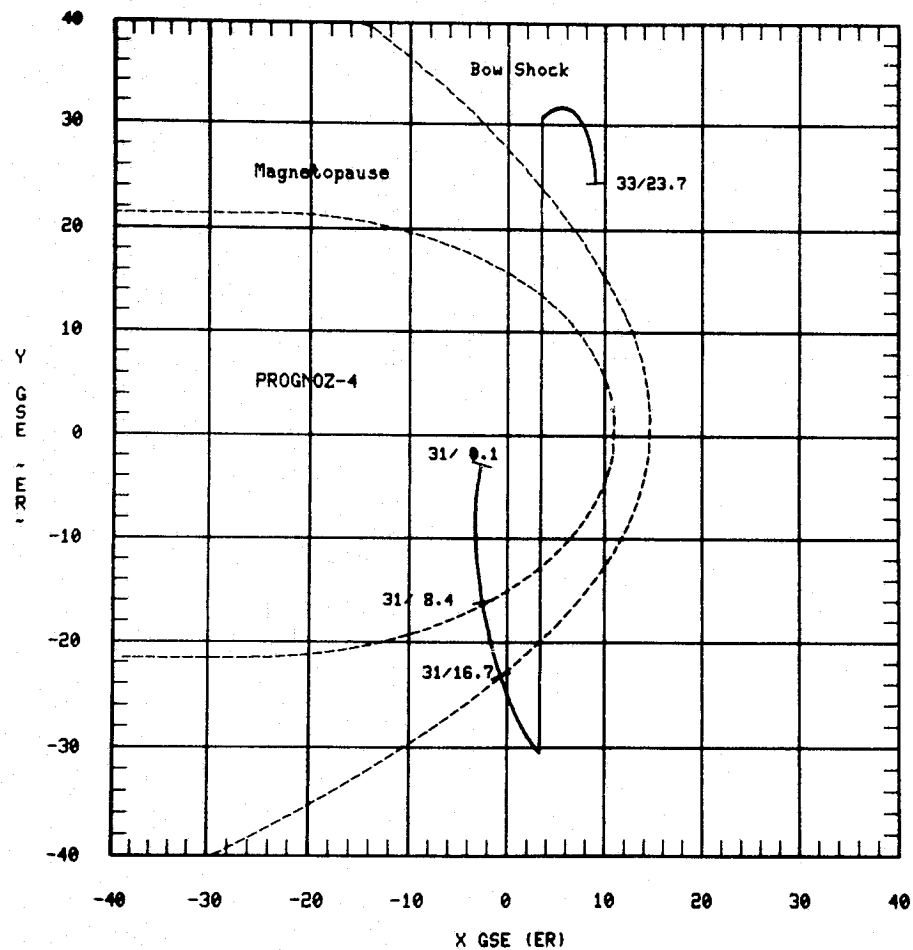
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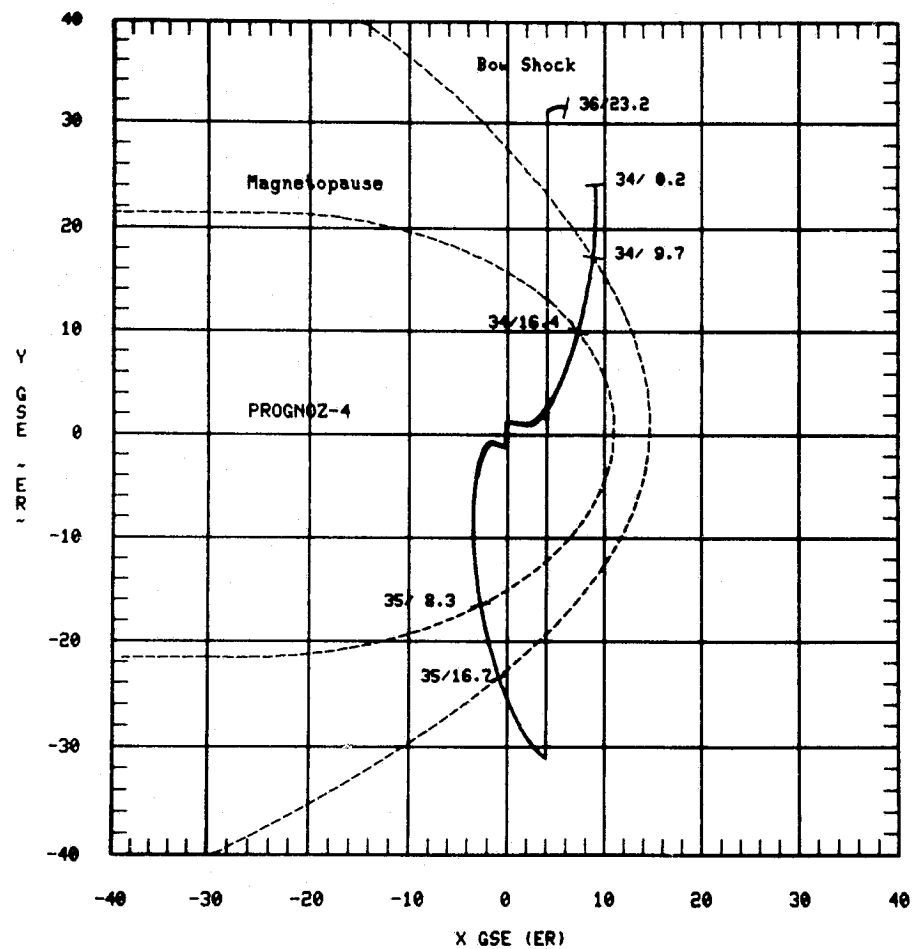
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GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



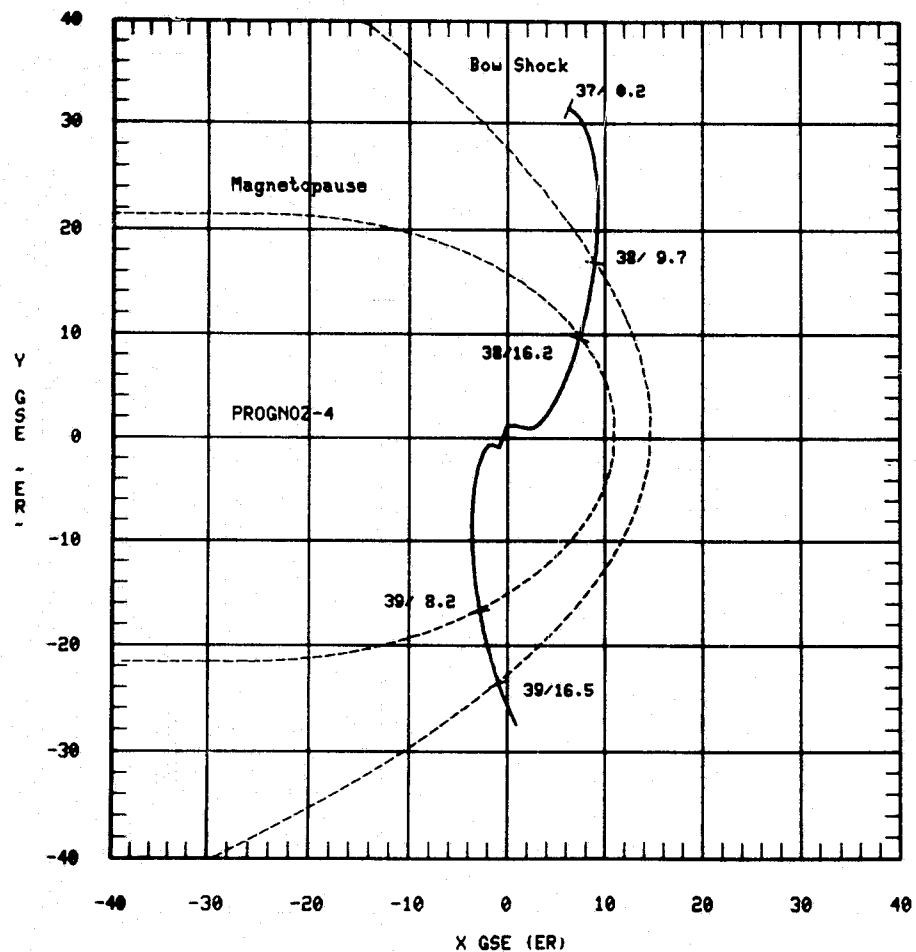
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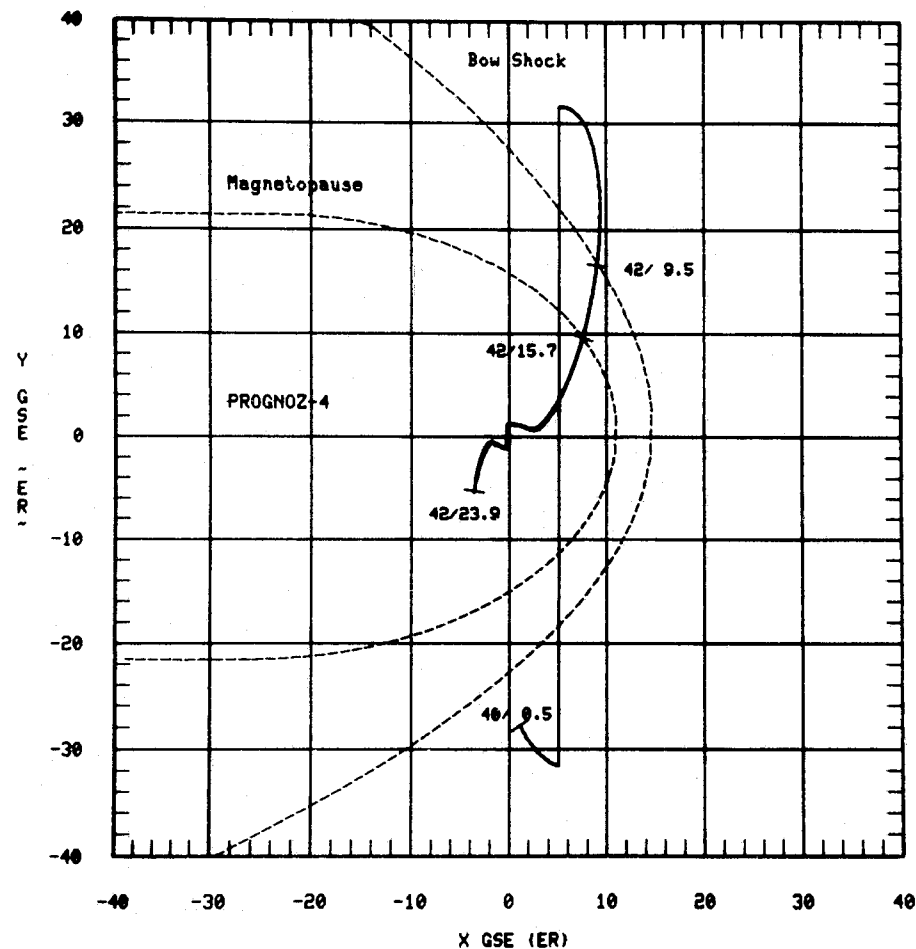
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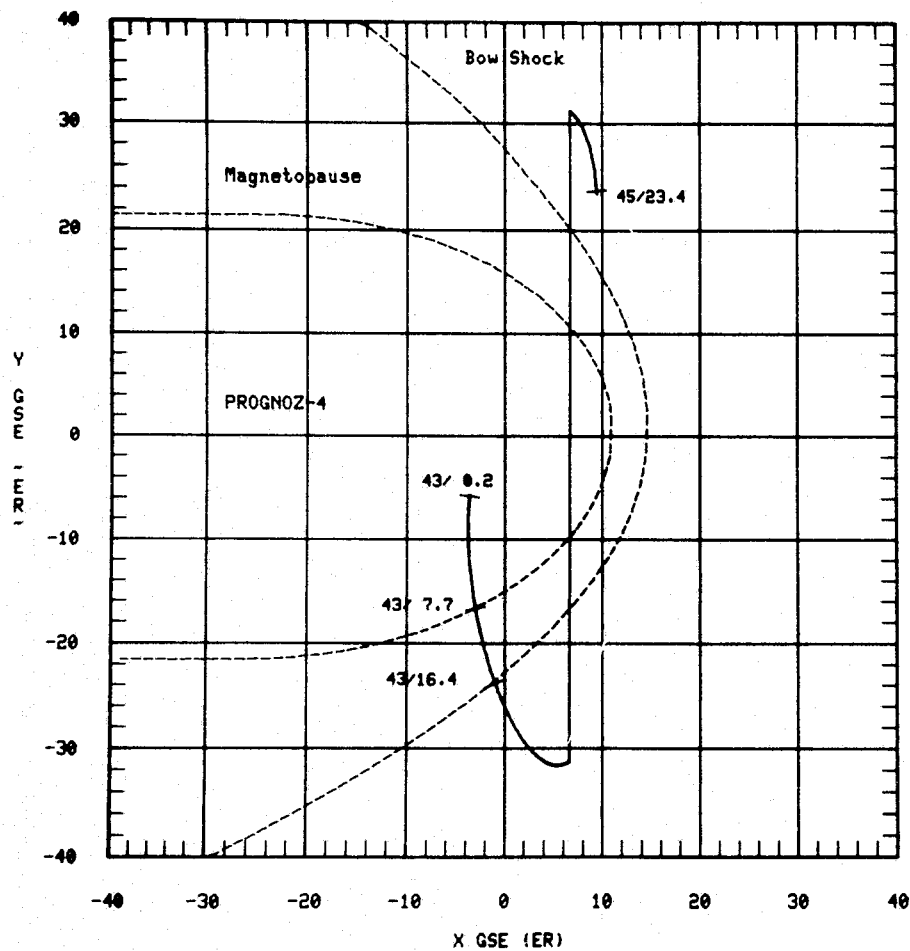
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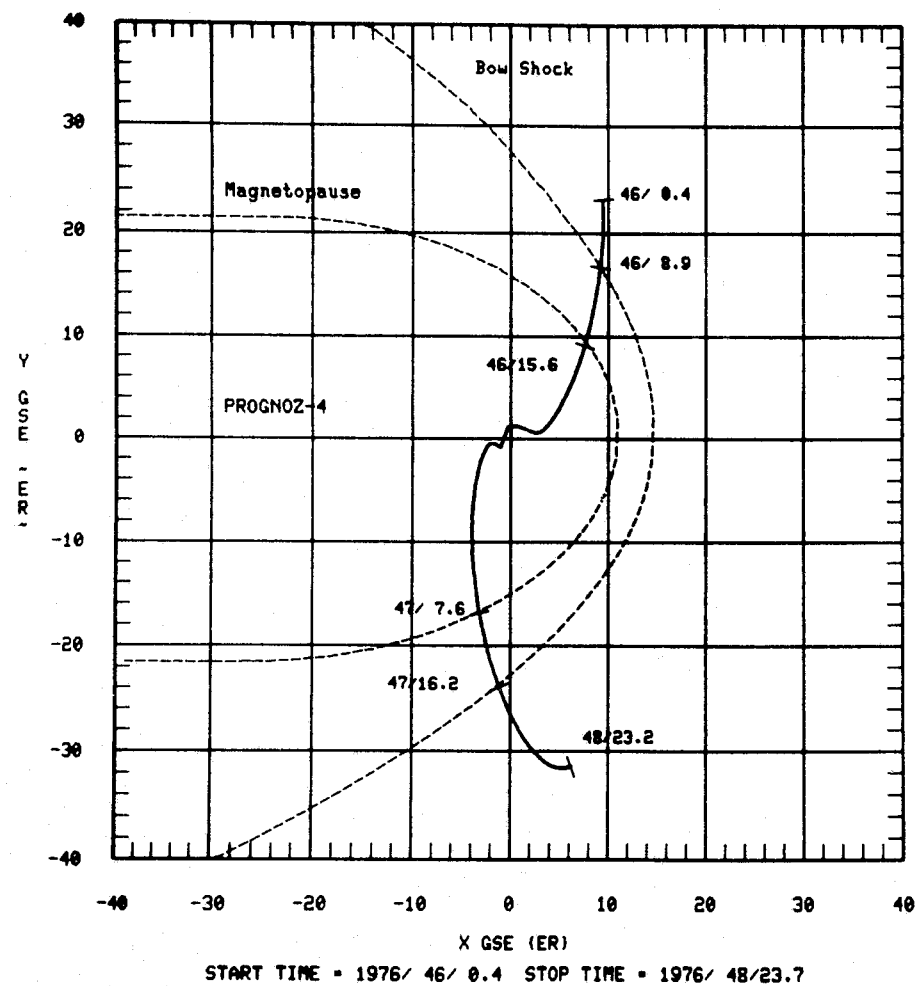


START TIME = 1976/ 40/ 0.5 STOP TIME = 1976/ 42/24.0

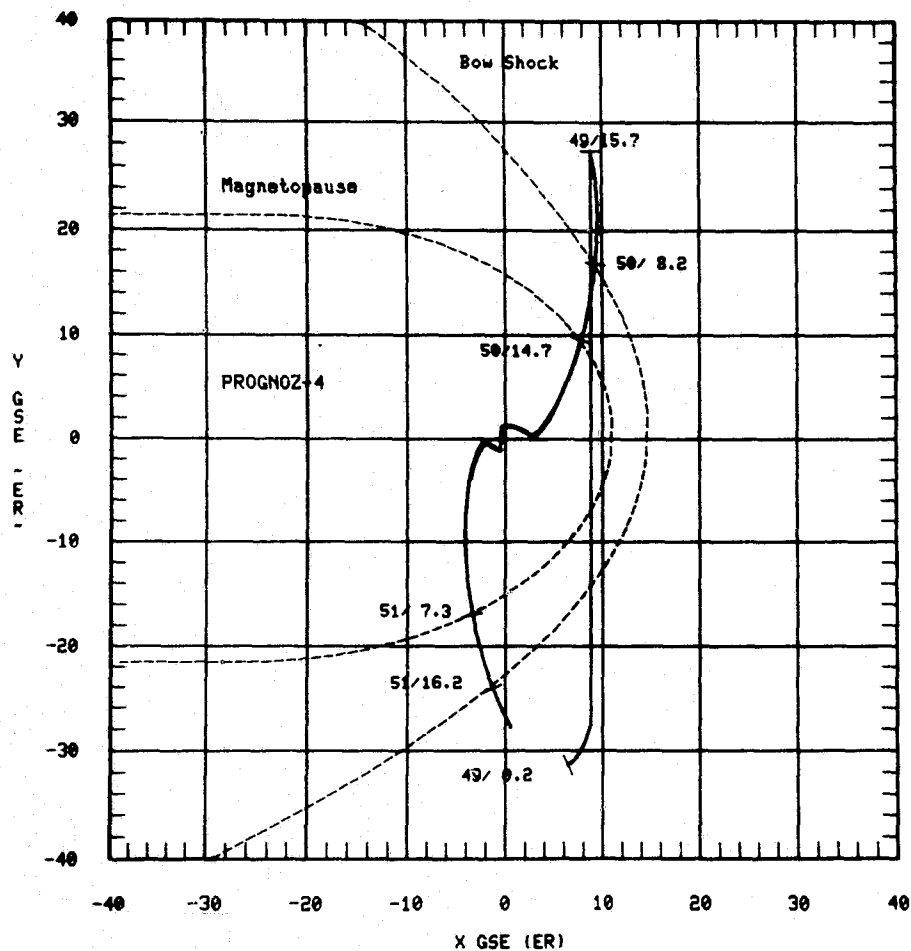
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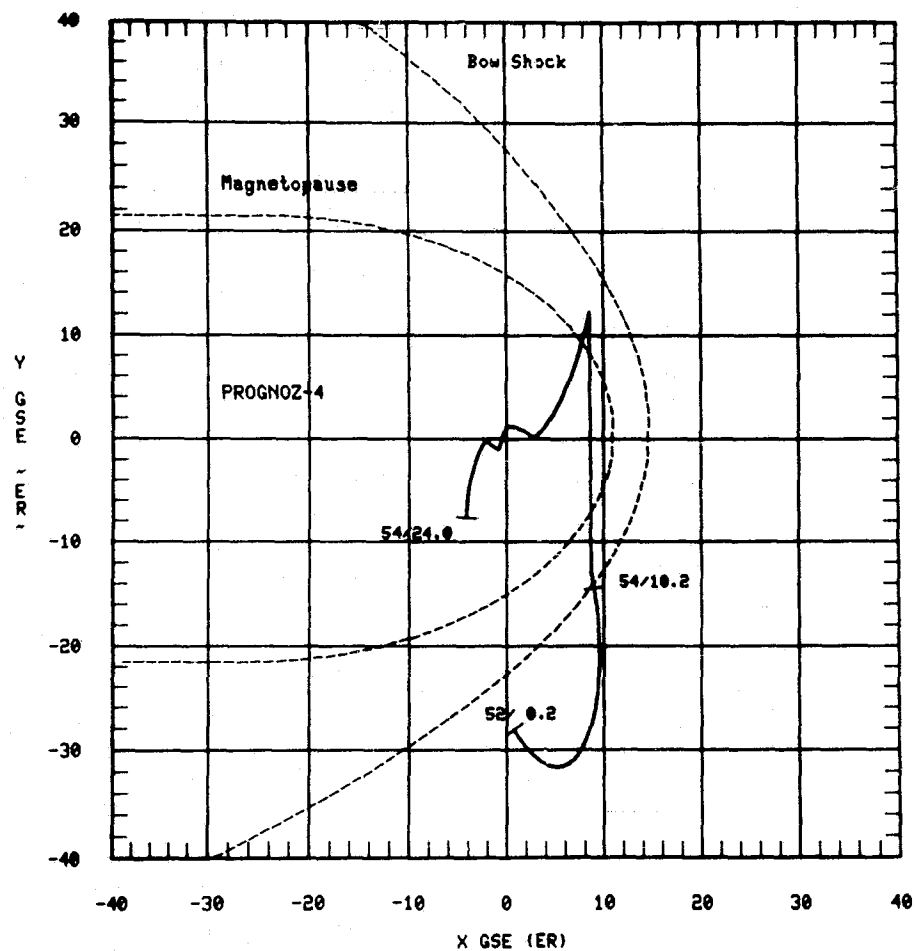


GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



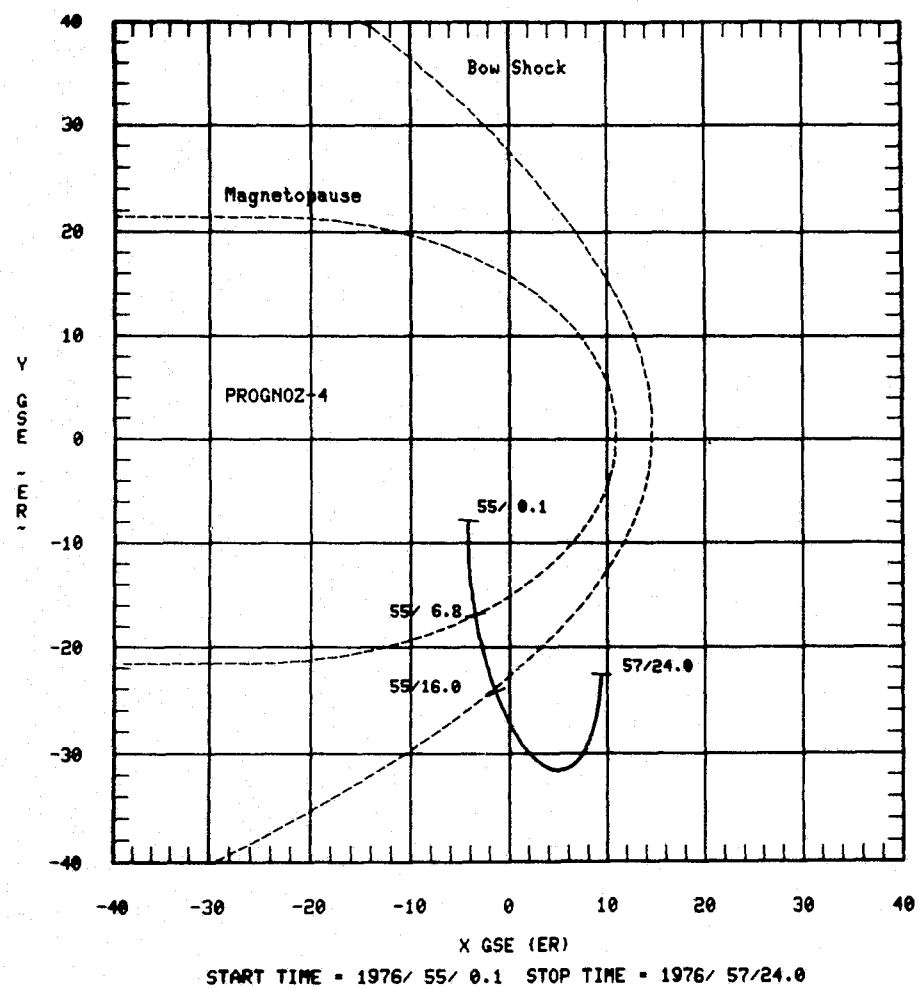
START TIME = 1976/ 49/ 0.2 STOP TIME = 1976/ 51/23.7

GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION

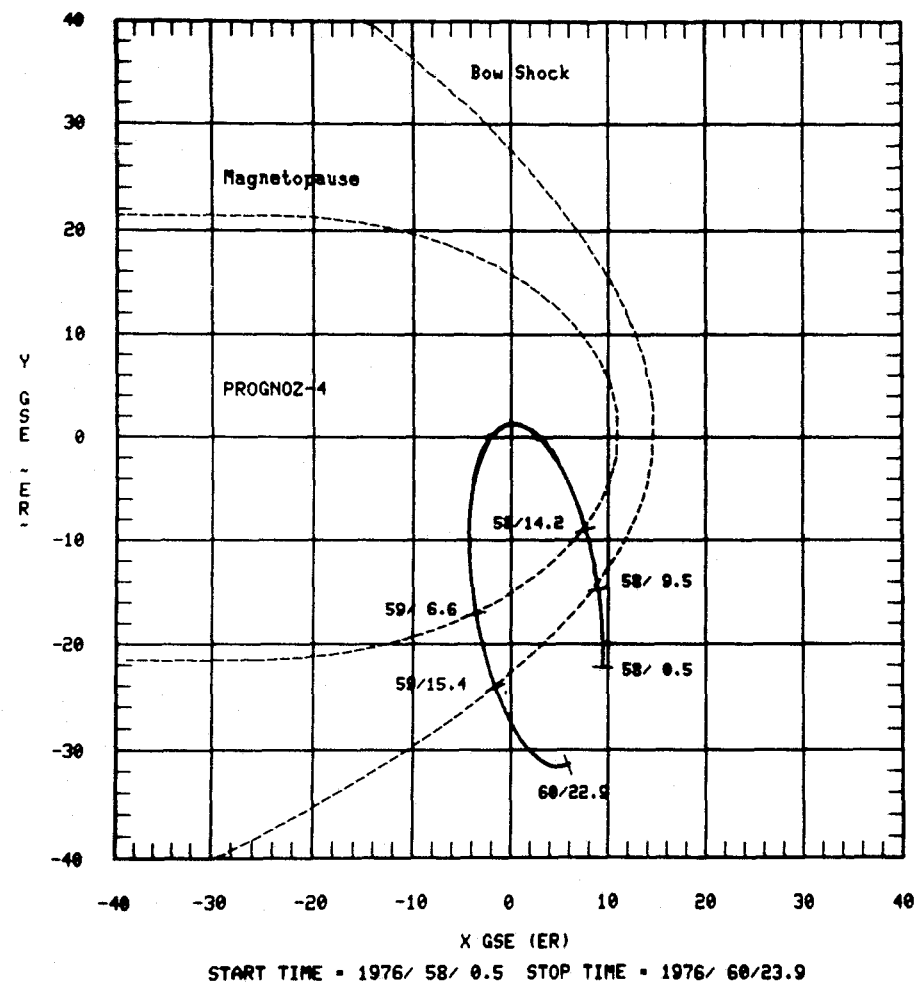


START TIME = 1976/ 52/ 0.2 STOP TIME = 1976/ 54/24.0

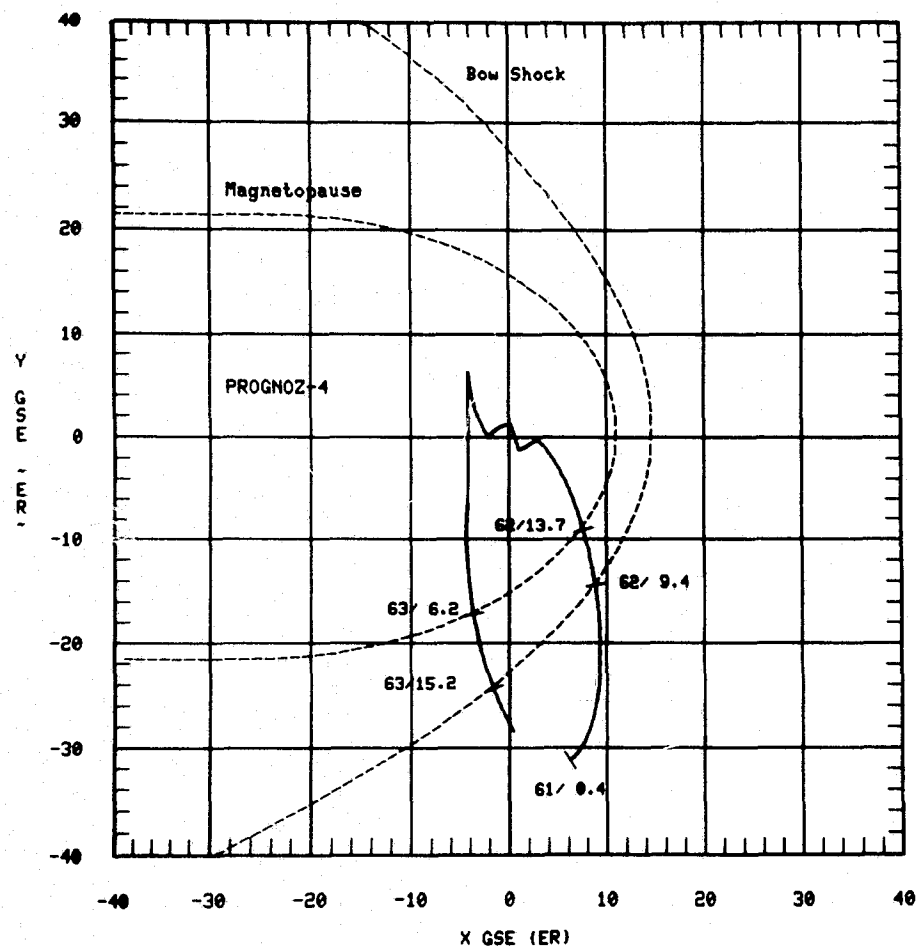
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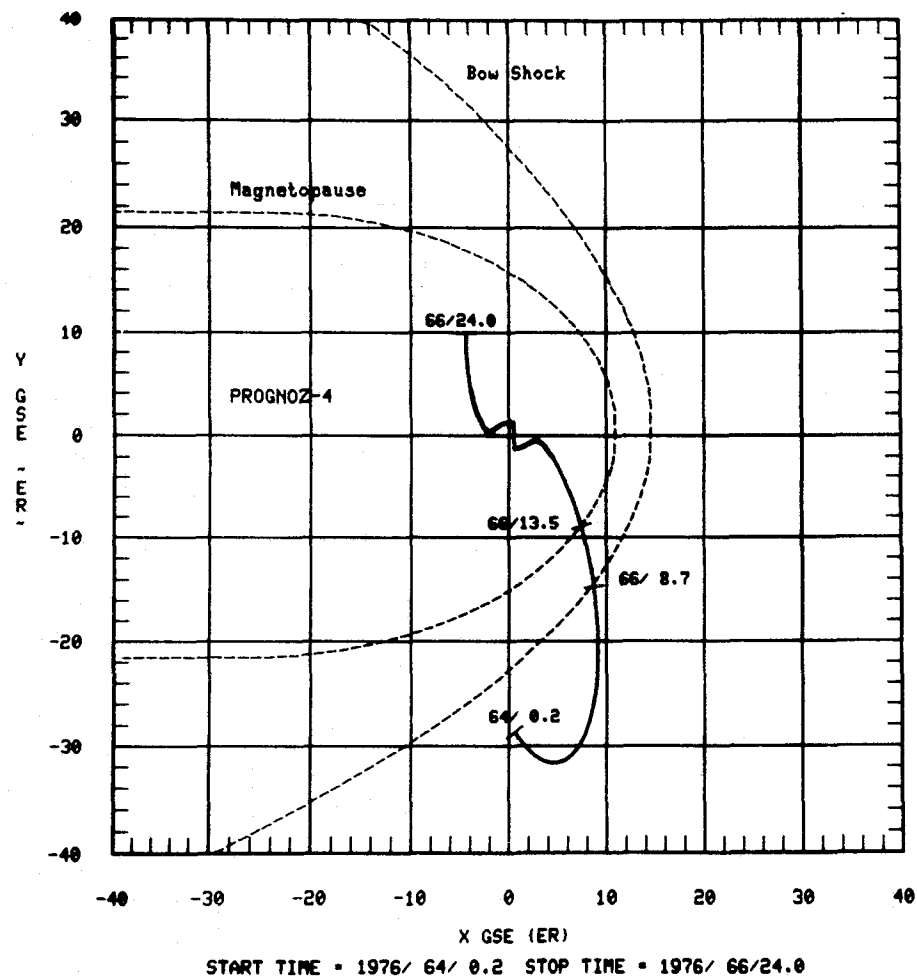
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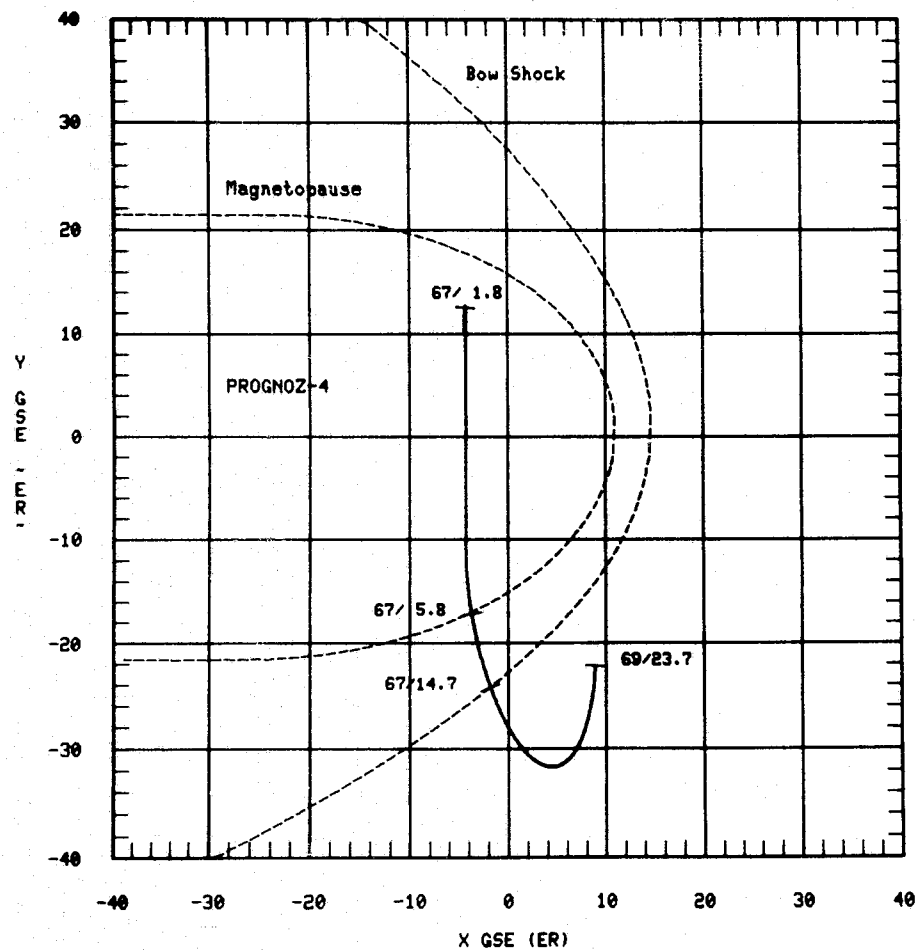
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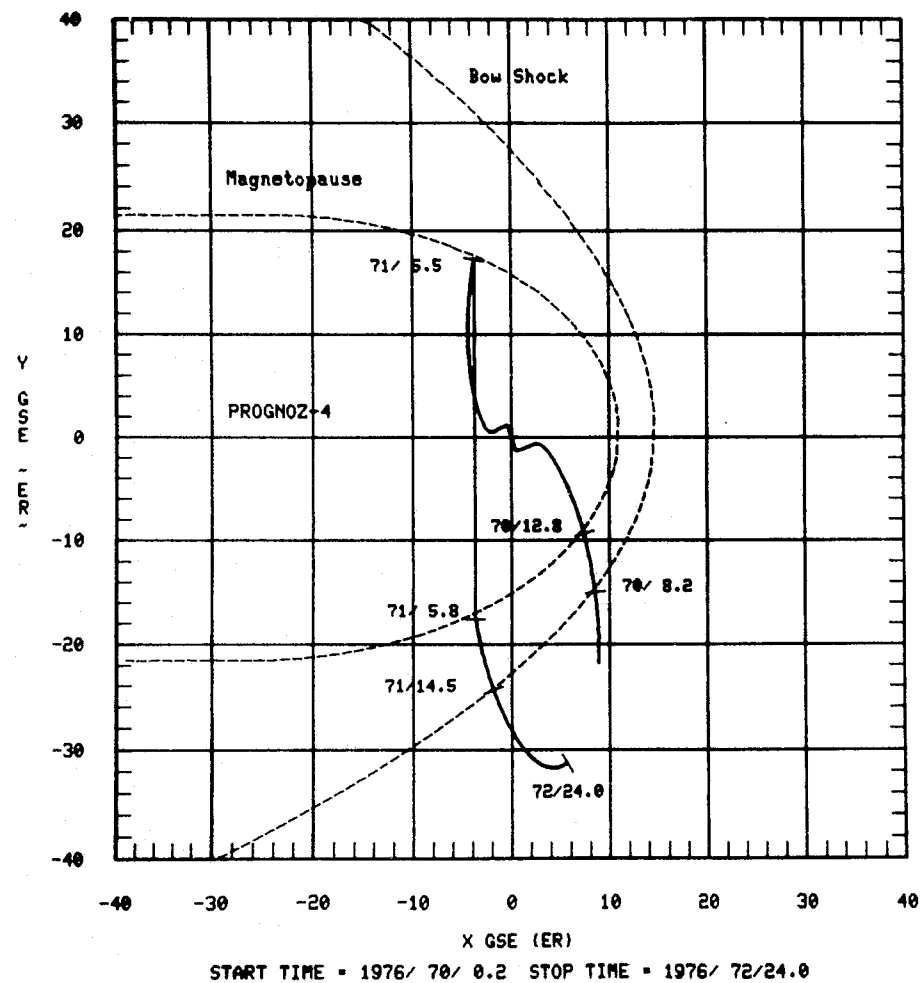
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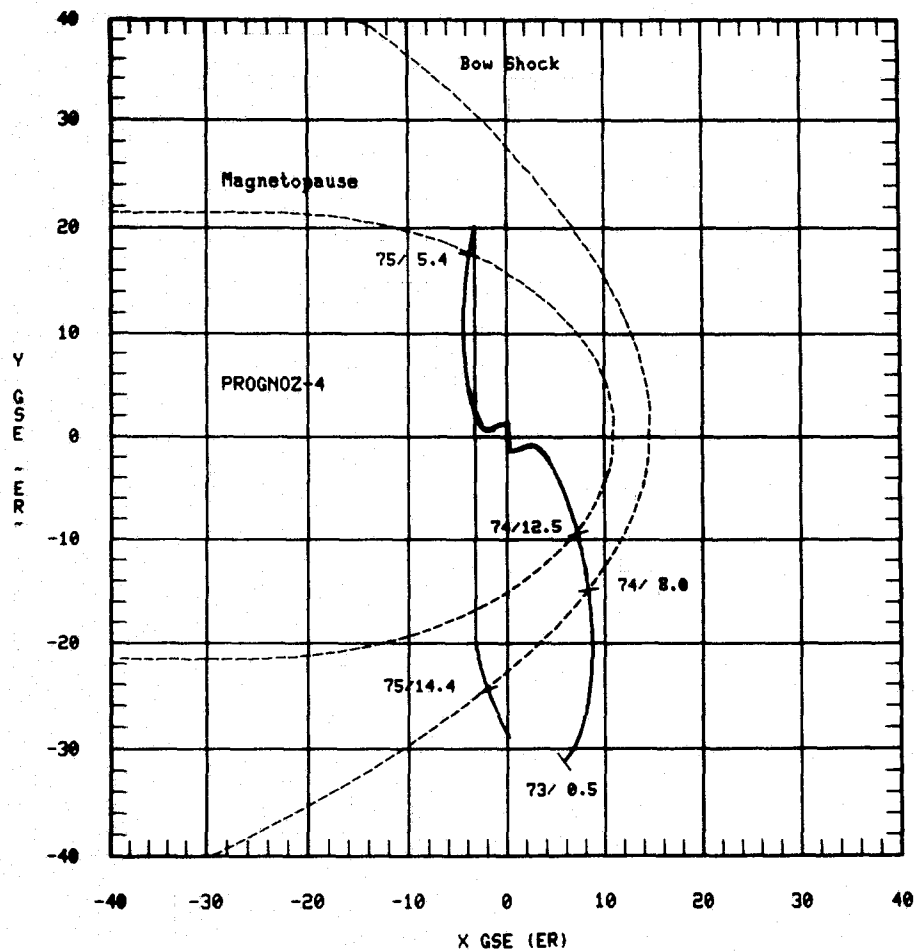
GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION

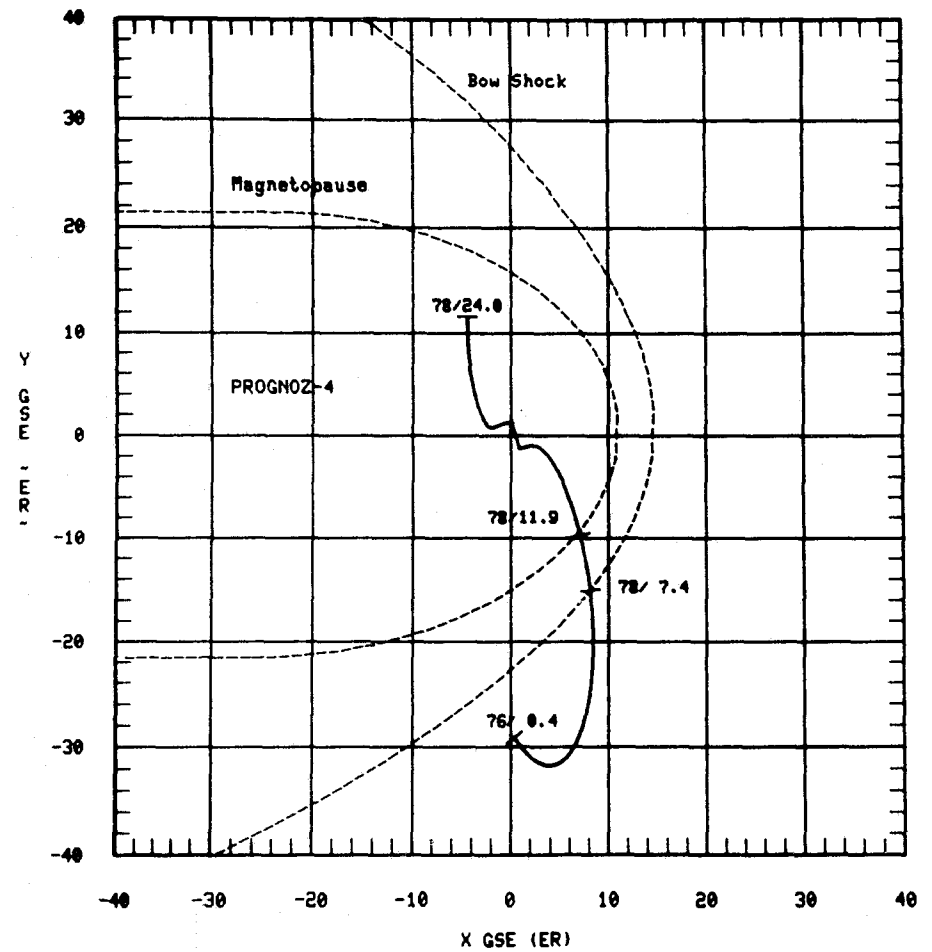


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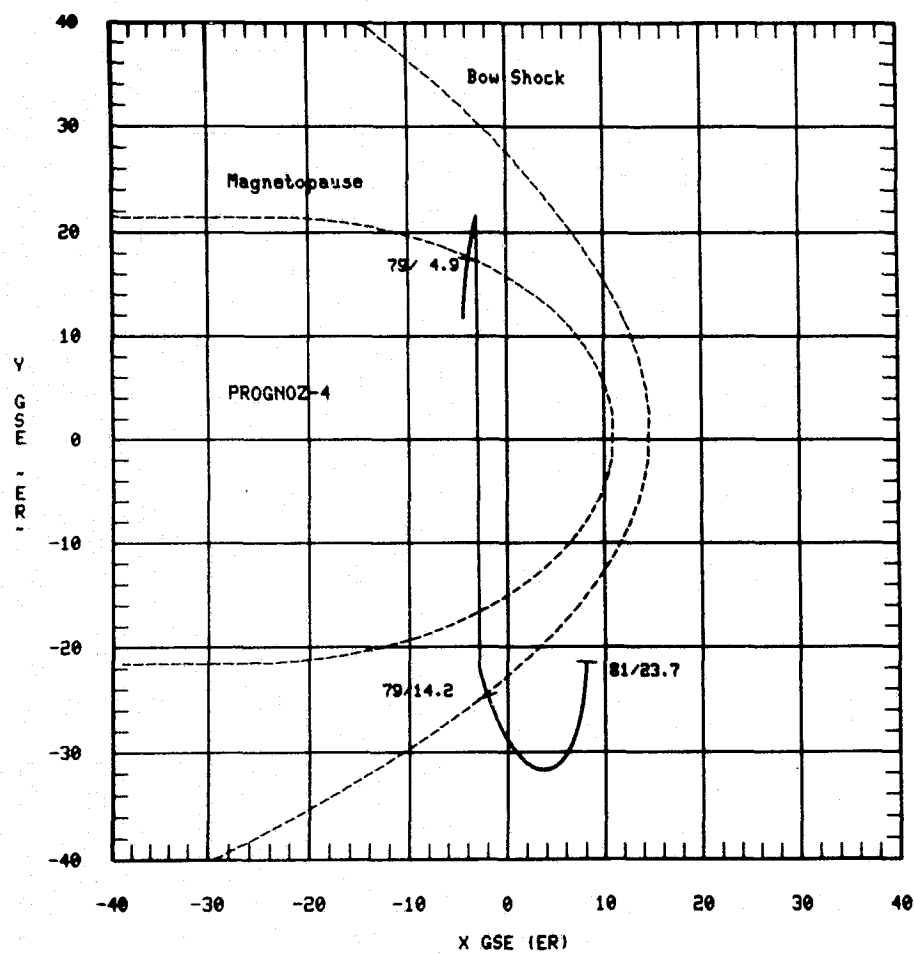
START TIME = 1976/ 73/ 0.5 STOP TIME = 1976/ 75/23.9

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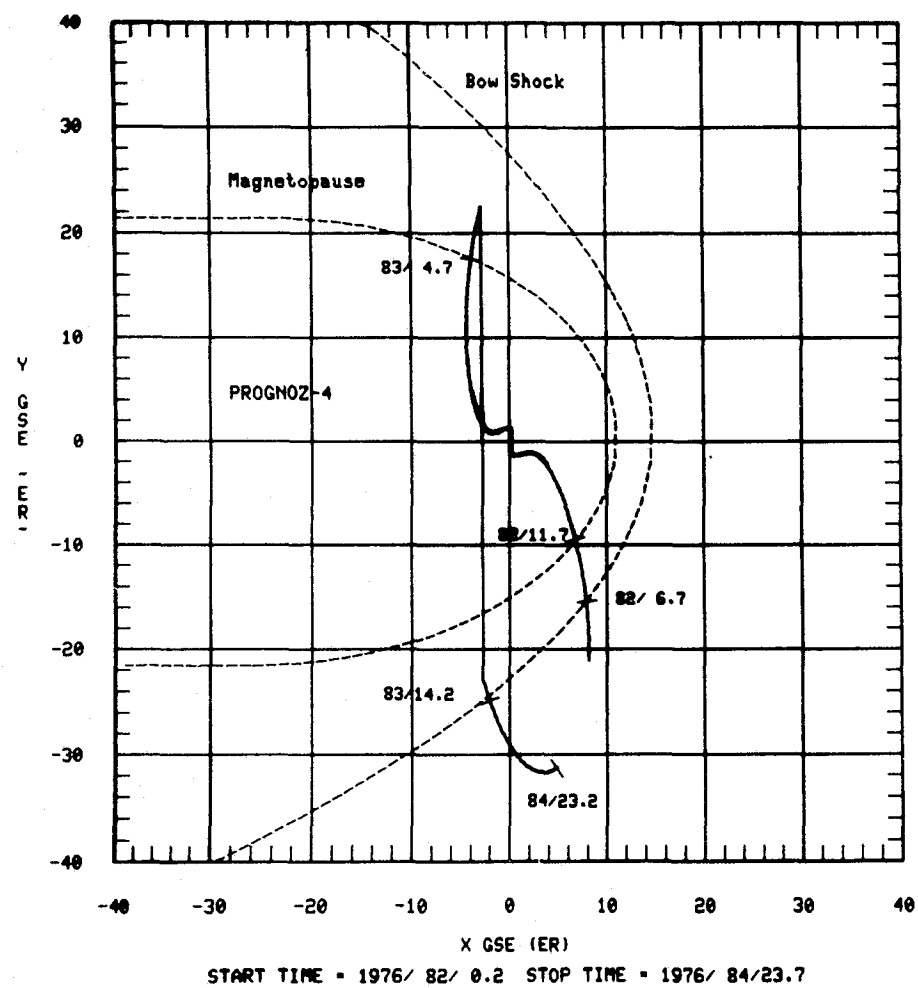


START TIME = 1976/ 76/ 0.4 STOP TIME = 1976/ 78/24.0

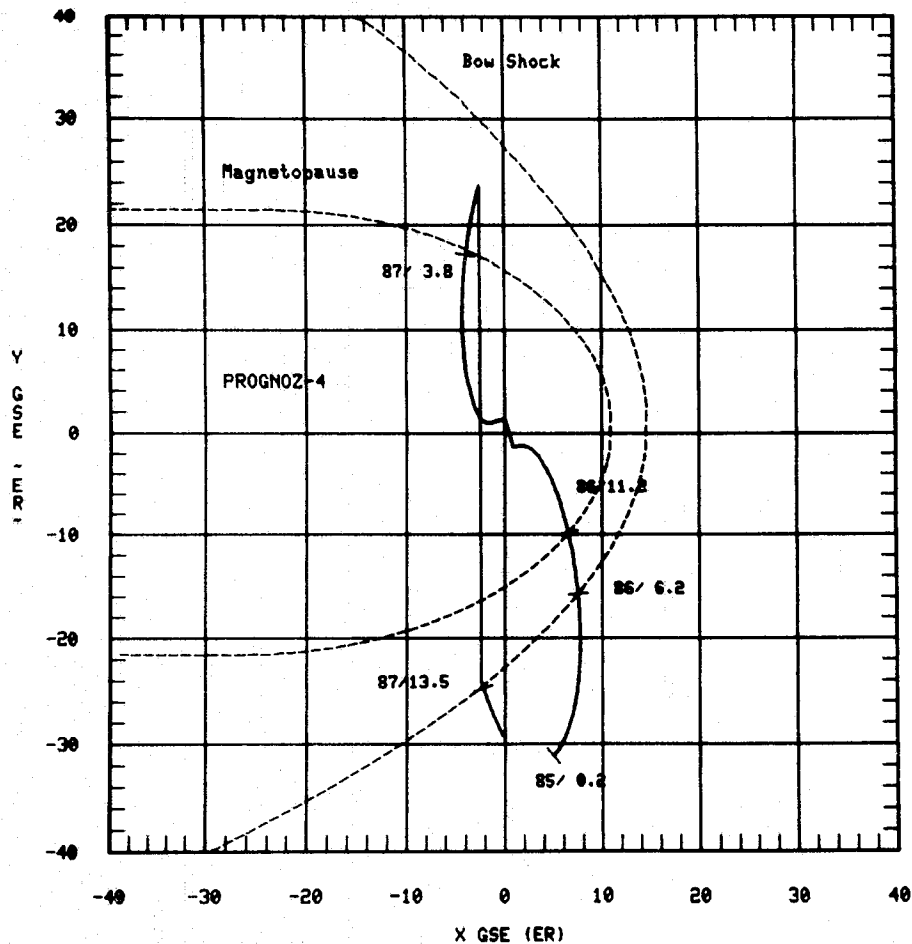
GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION

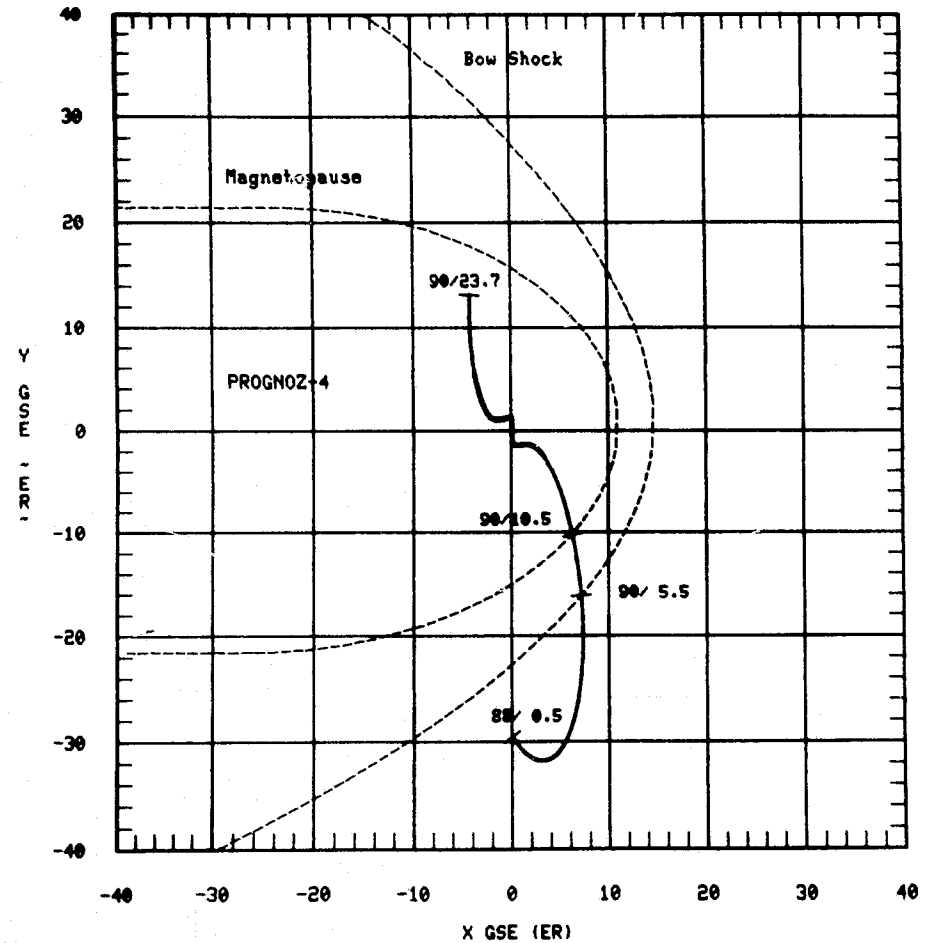


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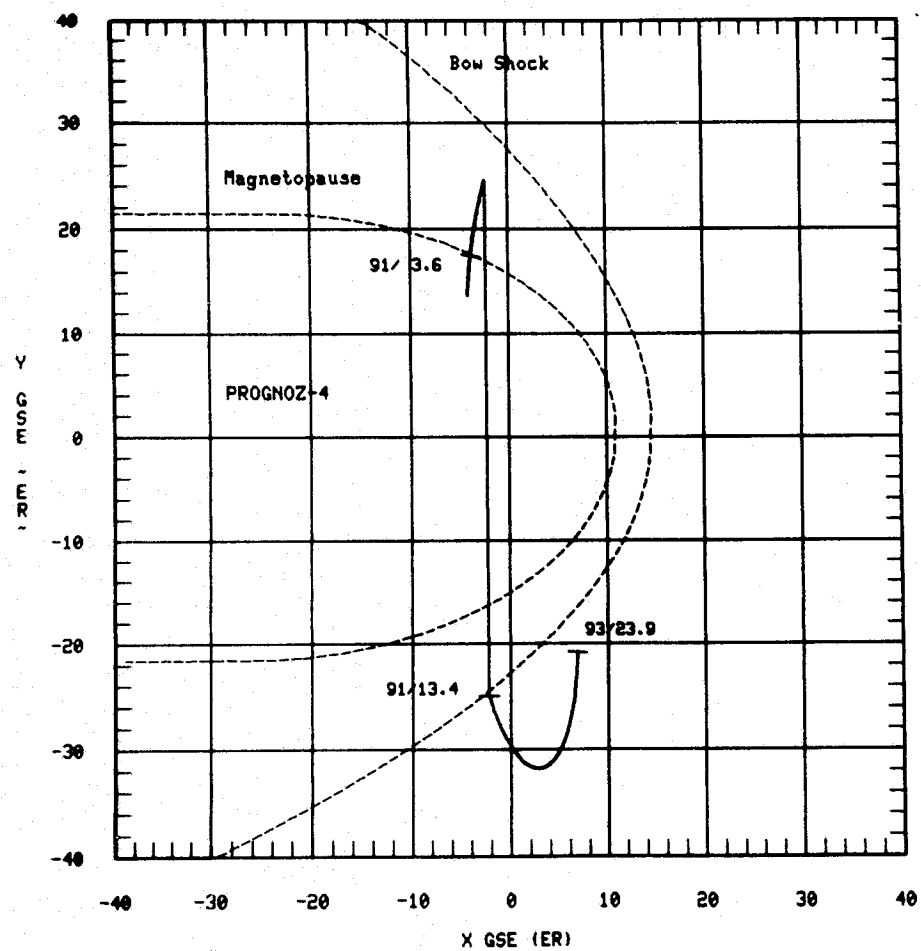
START TIME = 1976/ 85/ 0.2 STOP TIME = 1976/ 87/24.0

GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



START TIME = 1976/ 88/ 0.5 STOP TIME = 1976/ 90/23.9

GEOCENTRIC SOLAR ECLIPTIC X-Y PROJECTION



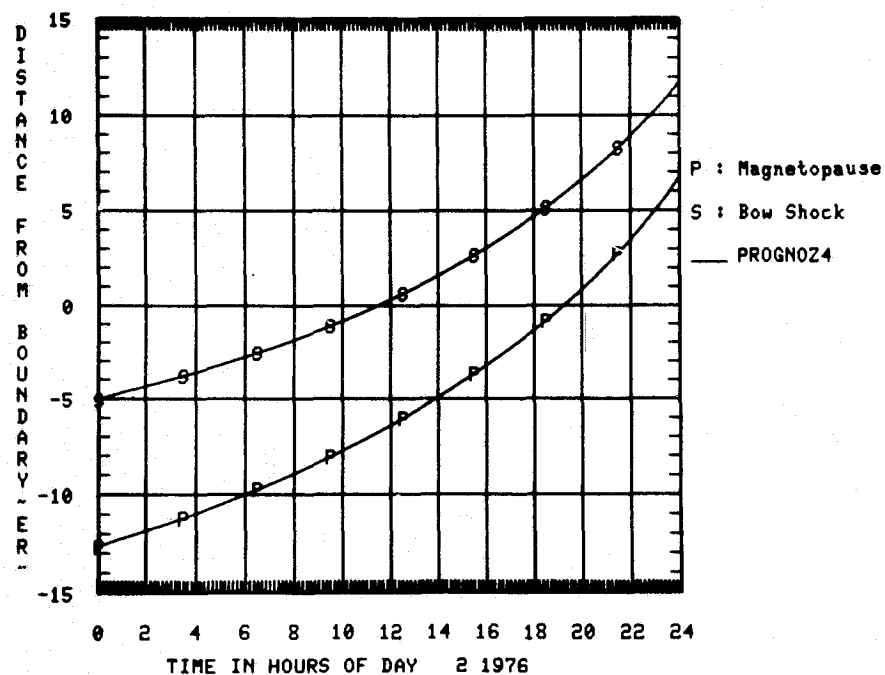
START TIME = 1976/ 91/ 0.1 STOP TIME = 1976/ 93/23.9

APPENDIX C

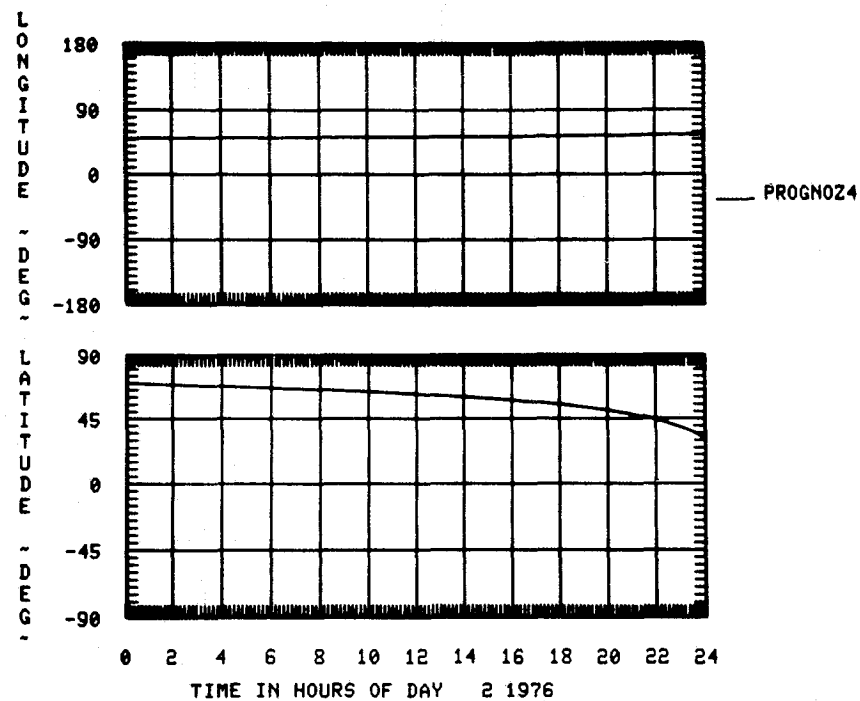
BOUNDARY PLOTS



BOUNDARY PLOT
SAT ID: PROGNOZ4

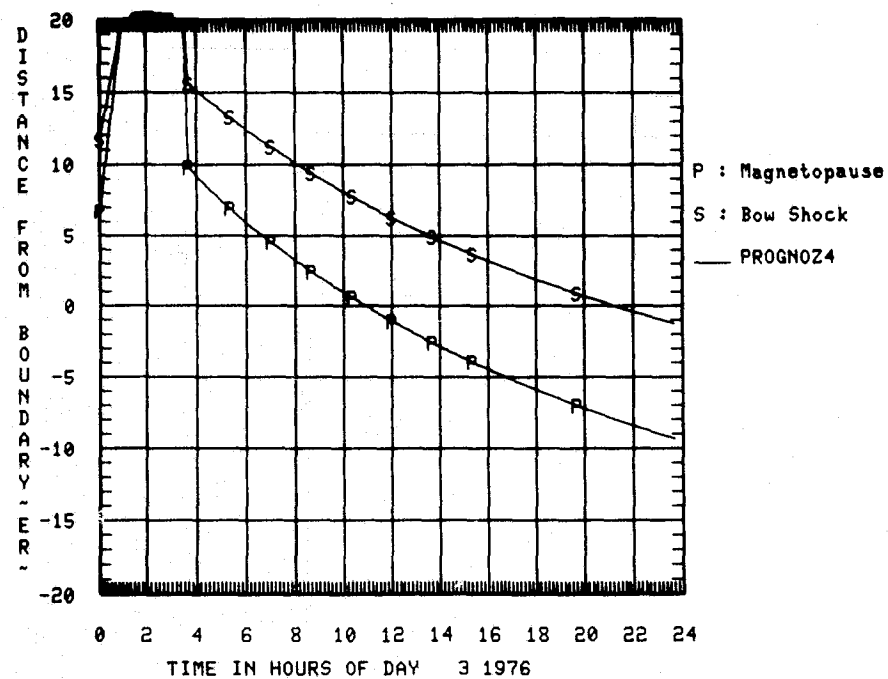


BOUNDARY PLOT
SAT ID: PROGNOZ4
ECLIPTIC POLAR COORDINATES



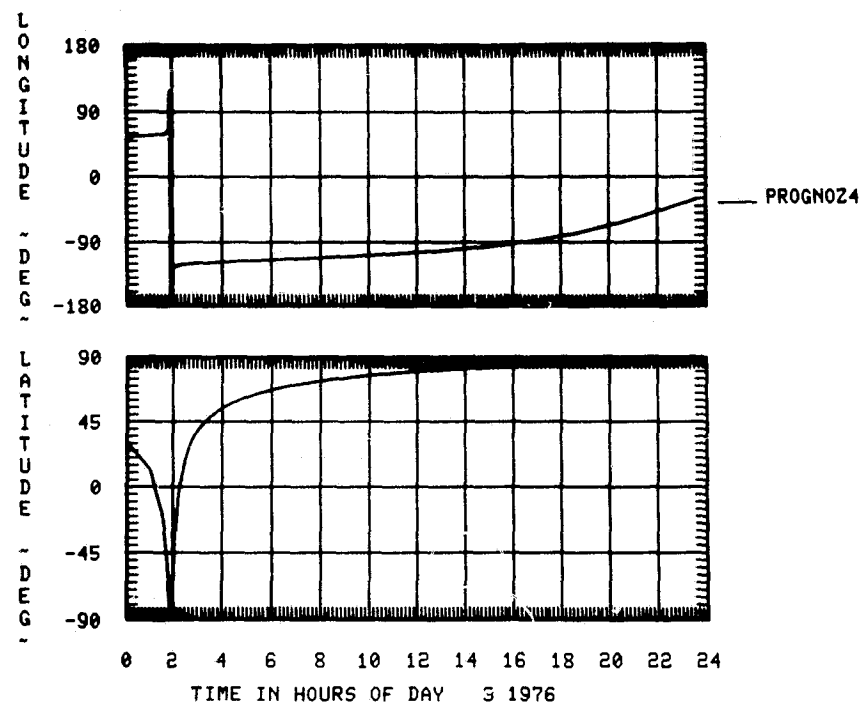
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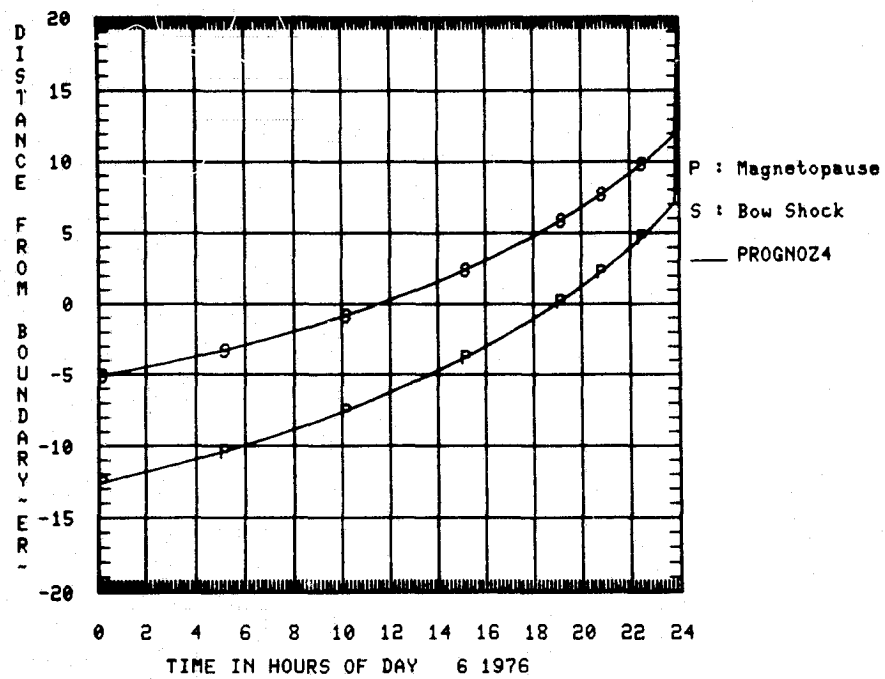


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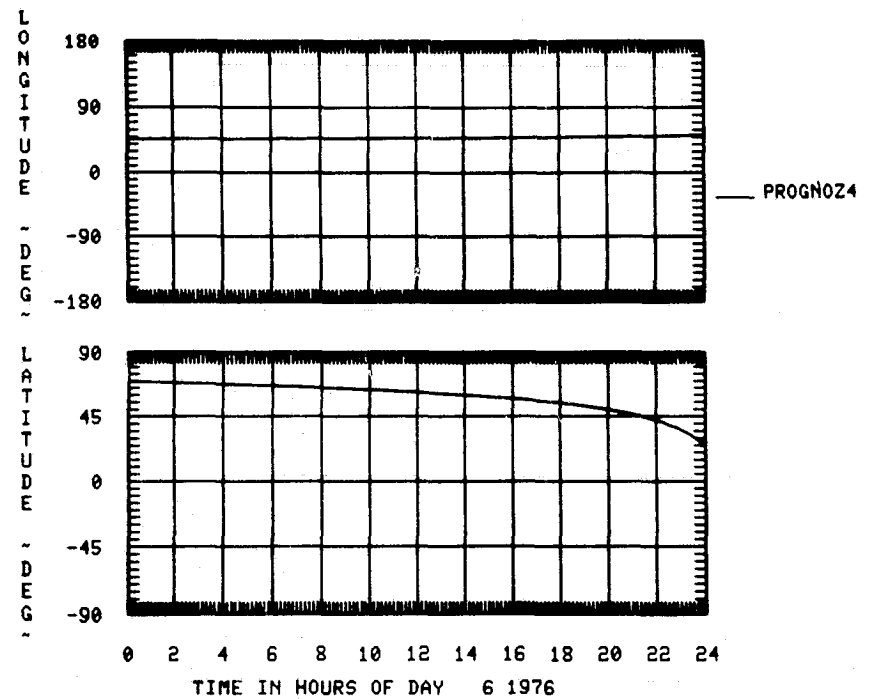
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ECLIPTIC POLAR COORDINATES



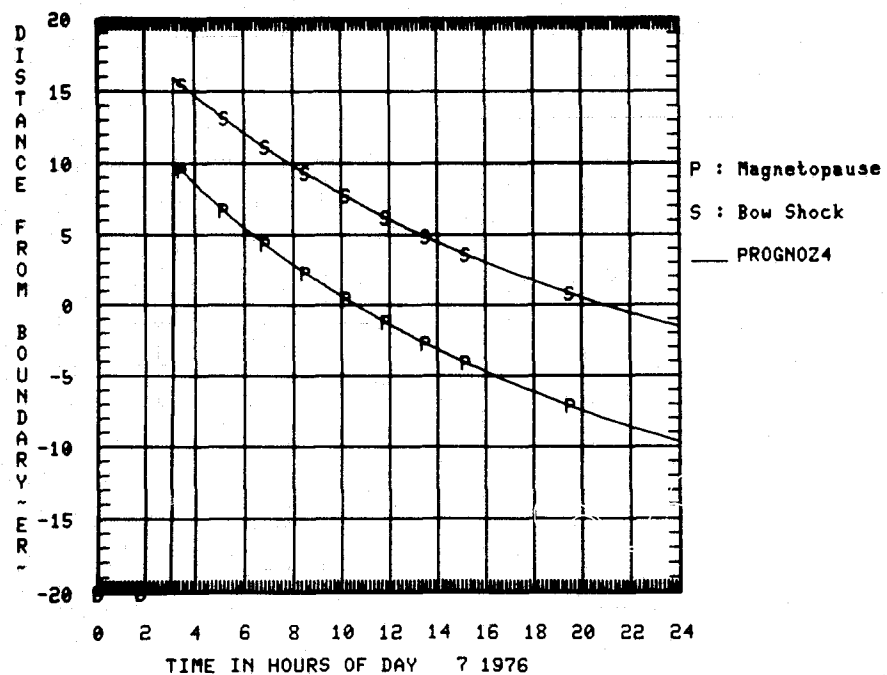
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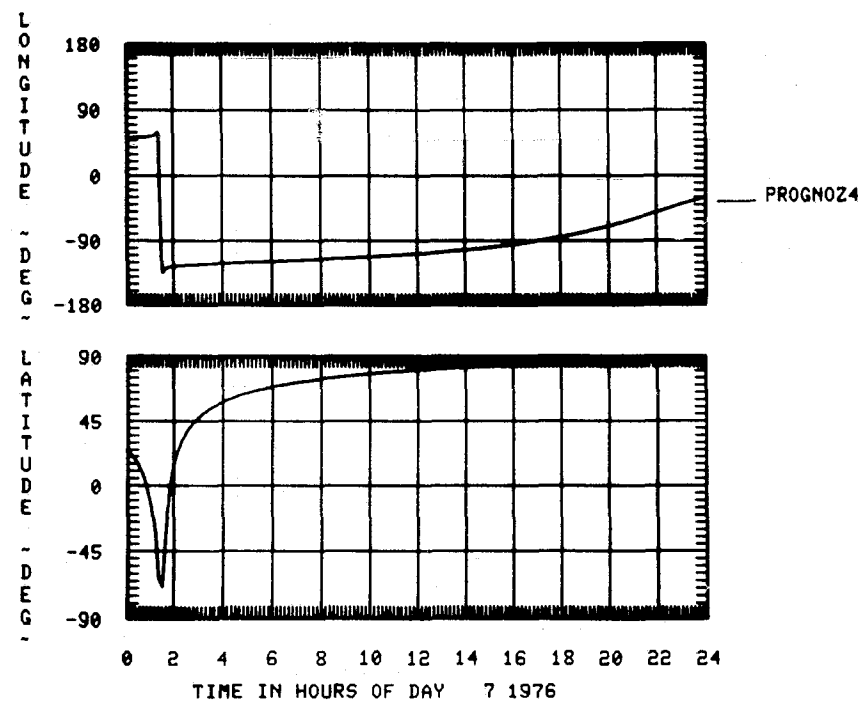
BOUNDARY PLOT
SAT ID: PROGNOZ4
ECLIPTIC POLAR COORDINATES



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SAT ID: PROGNOZ4

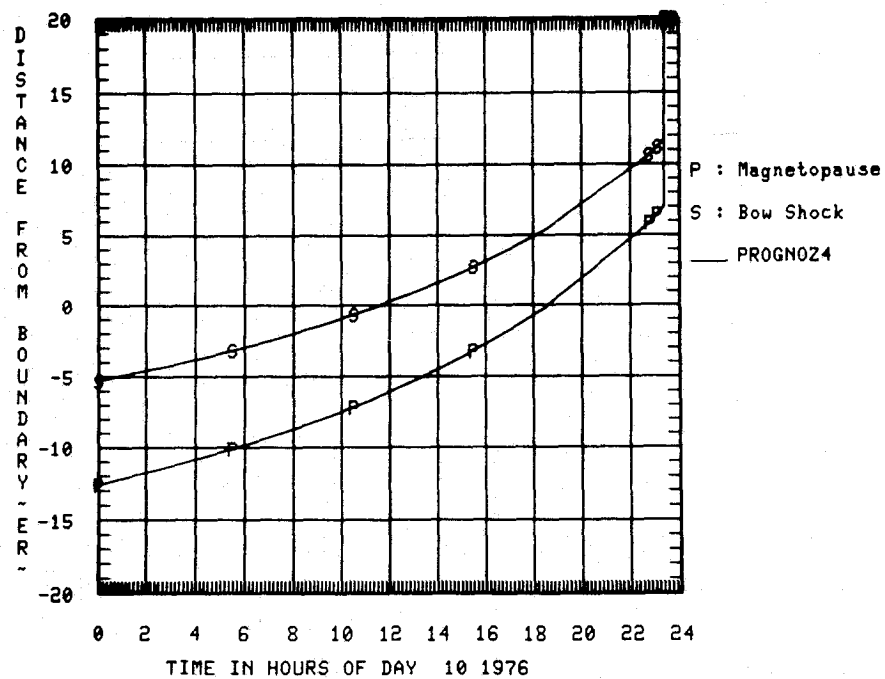


BOUNDARY PLOT
SAT ID: PROGNOZ4
ECLIPTIC POLAR COORDINATES



BOUNDARY PLOT

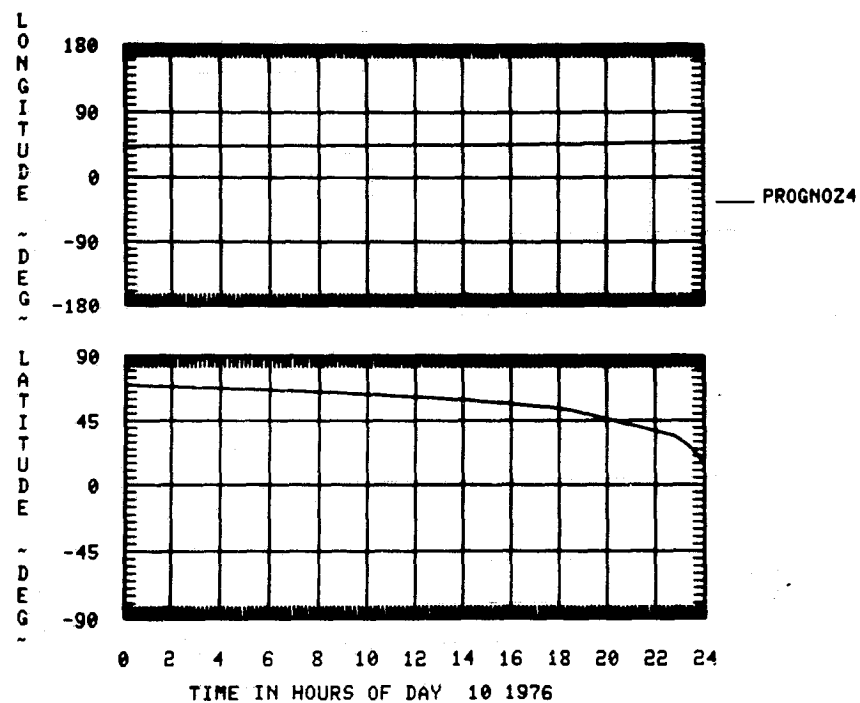
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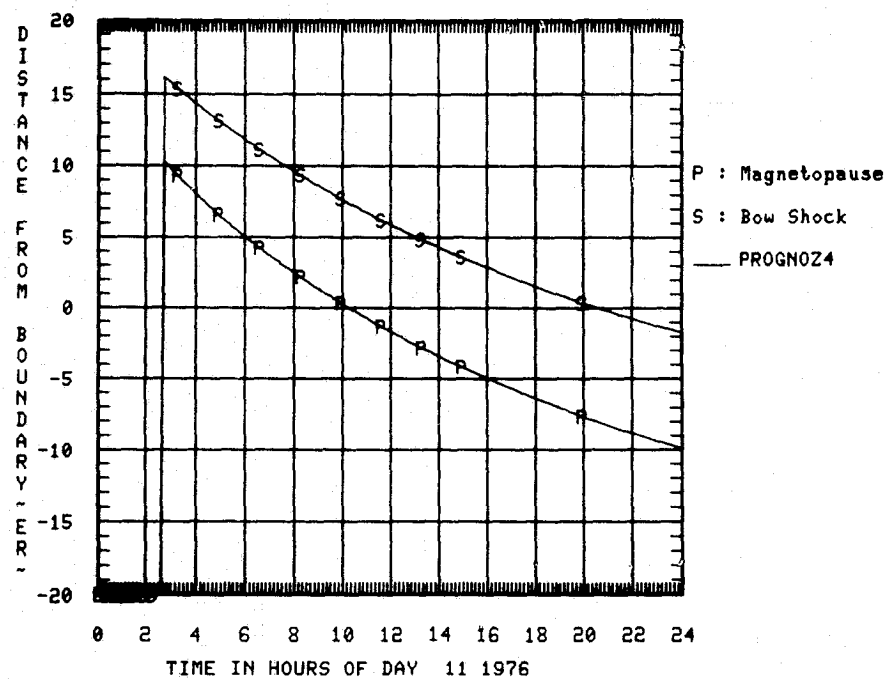
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ECLIPTIC POLAR COORDINATES



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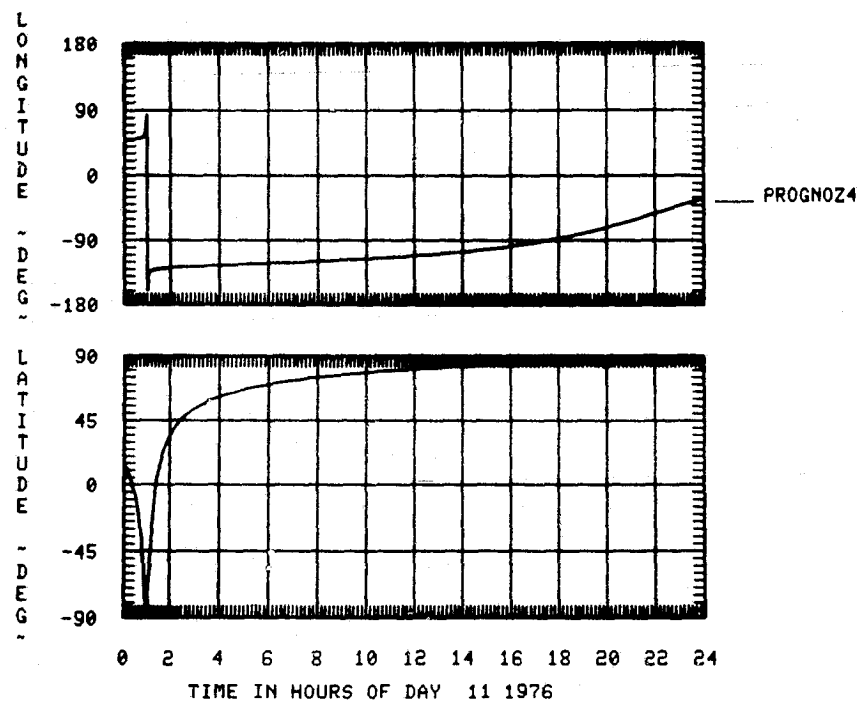
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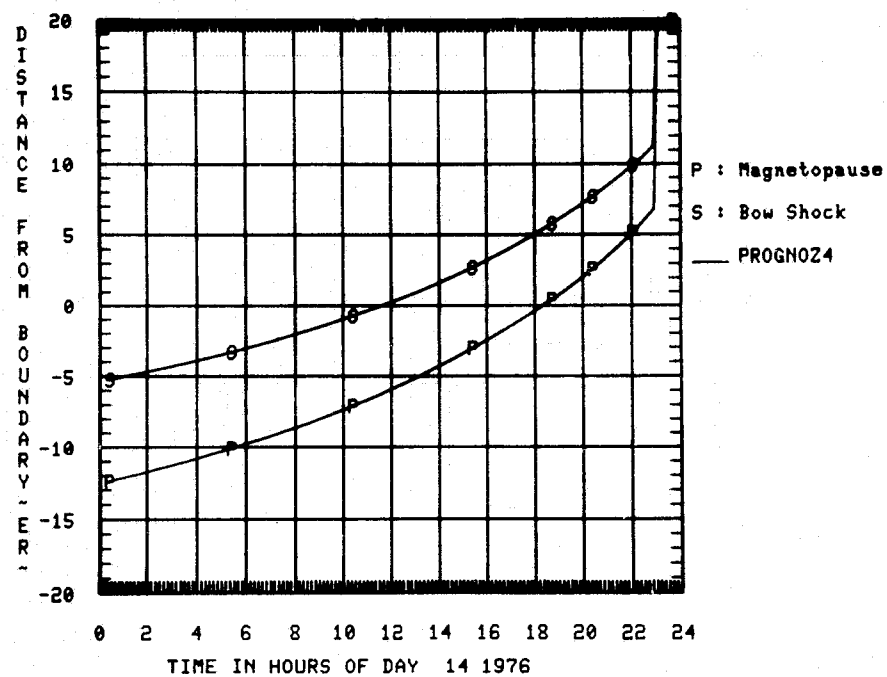
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ECLIPTIC POLAR COORDINATES



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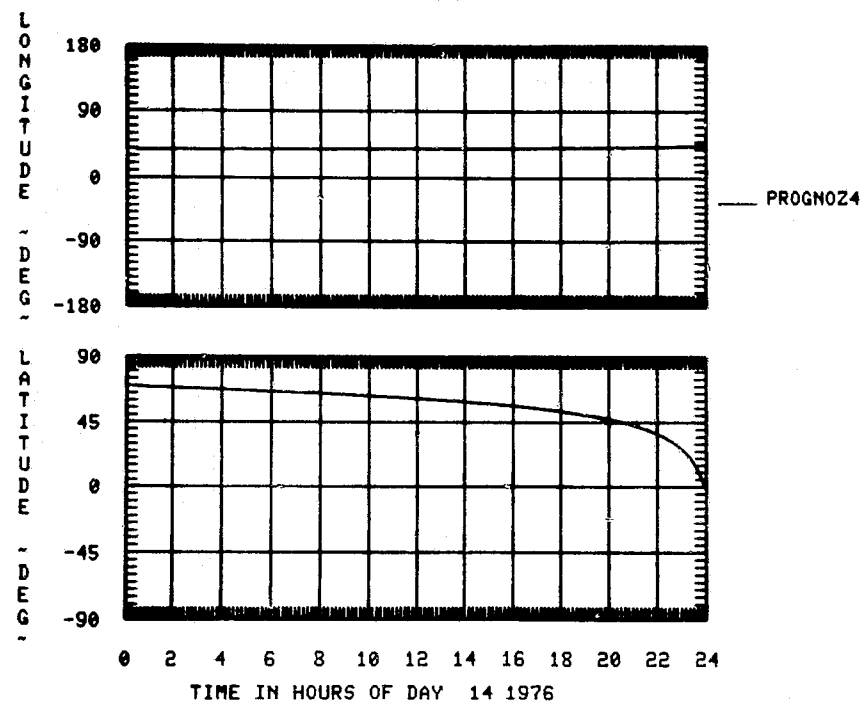
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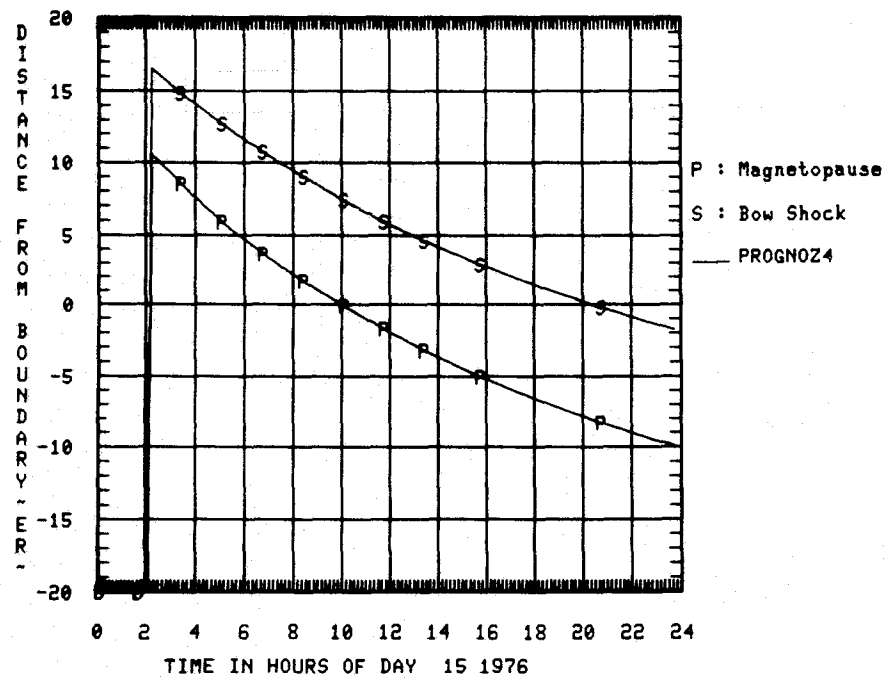
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ECLIPTIC POLAR COORDINATES



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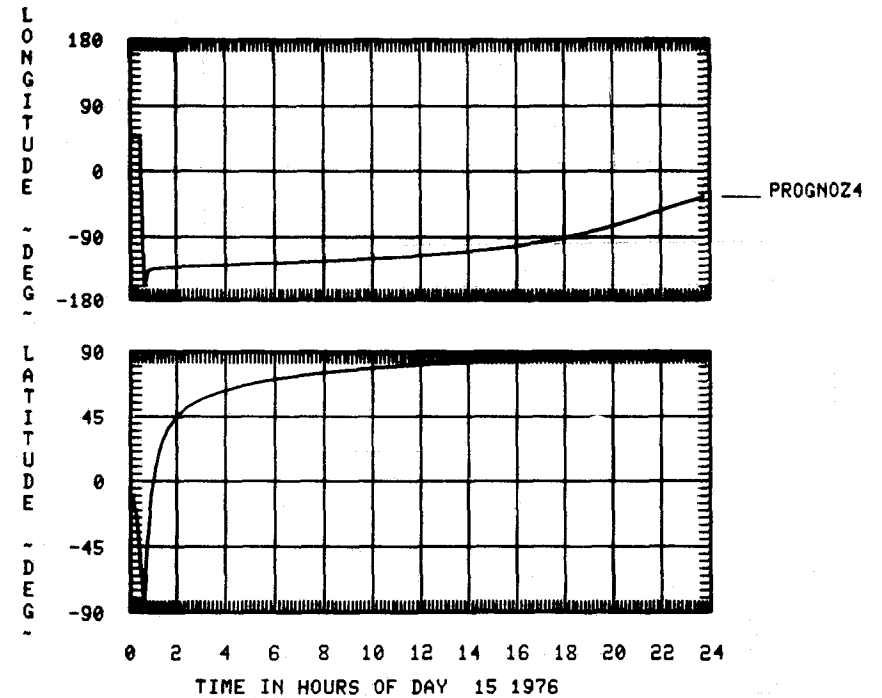
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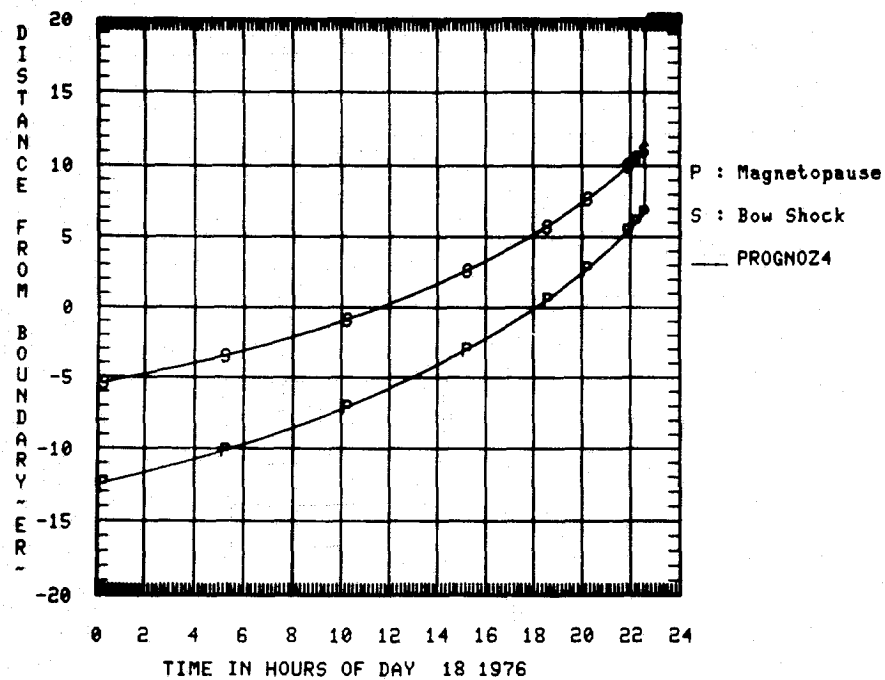
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ECLIPTIC POLAR COORDINATES



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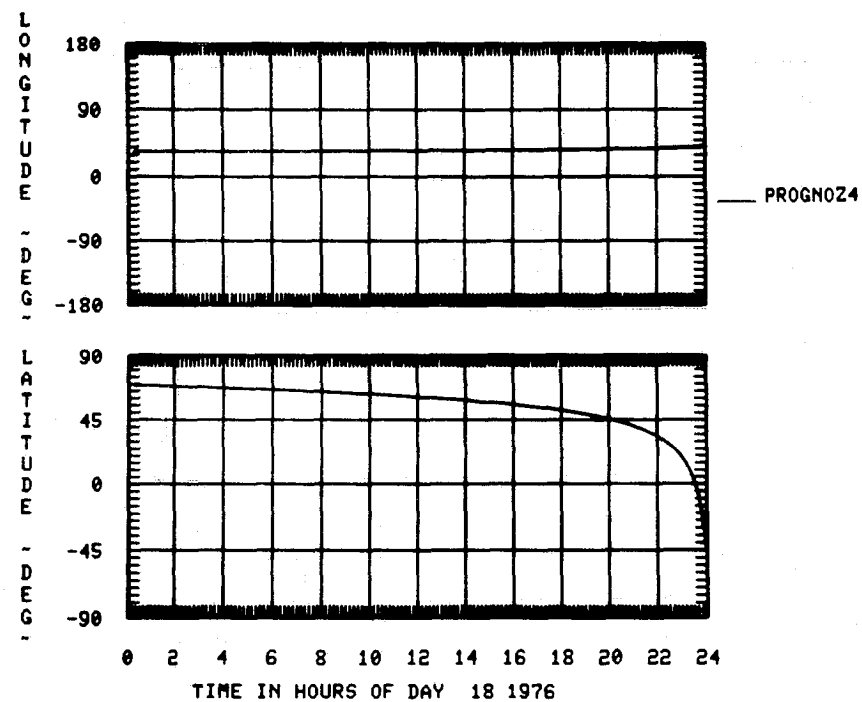
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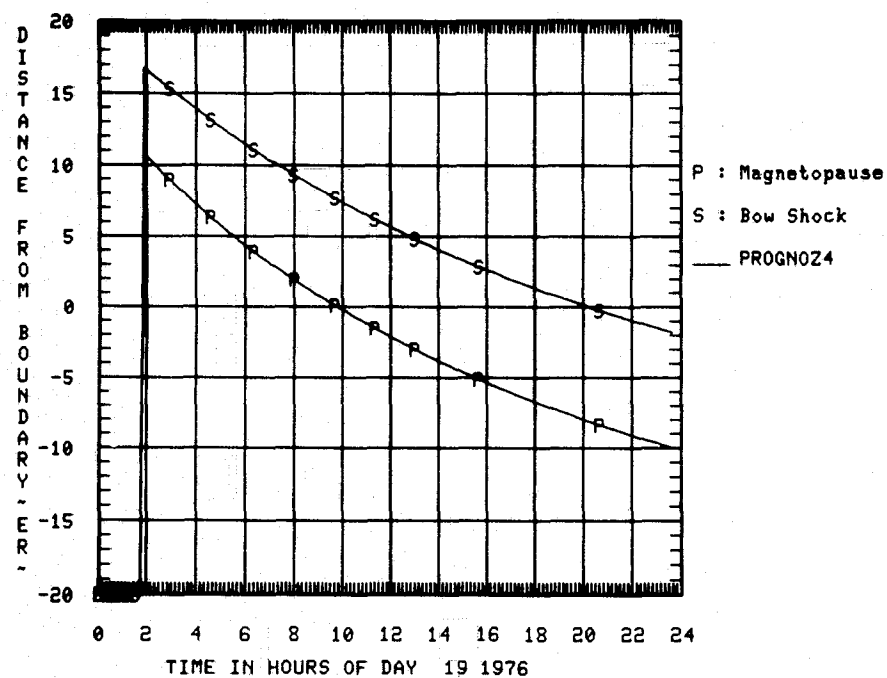
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ECLIPTIC POLAR COORDINATES



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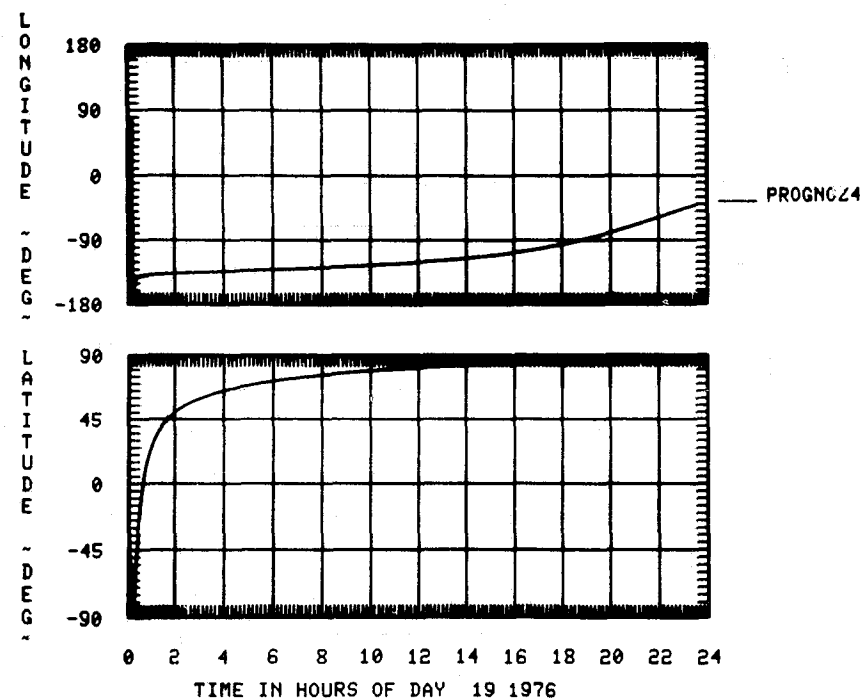
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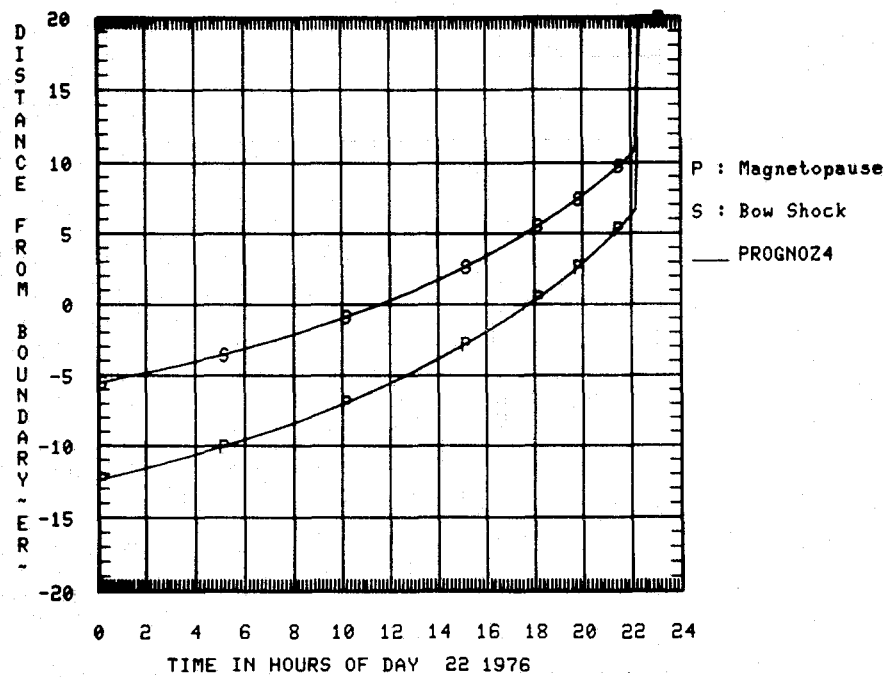
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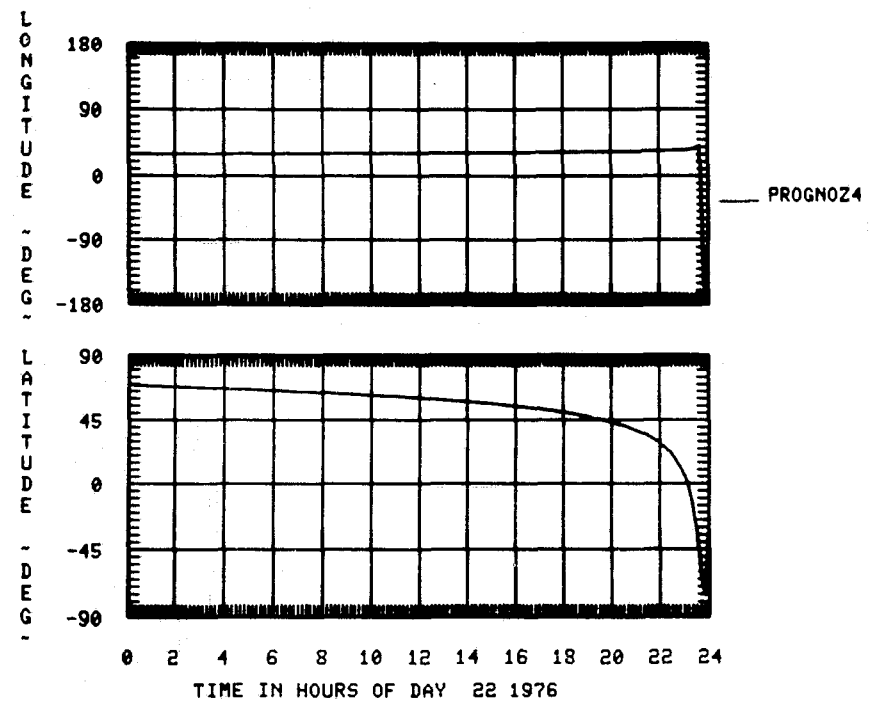
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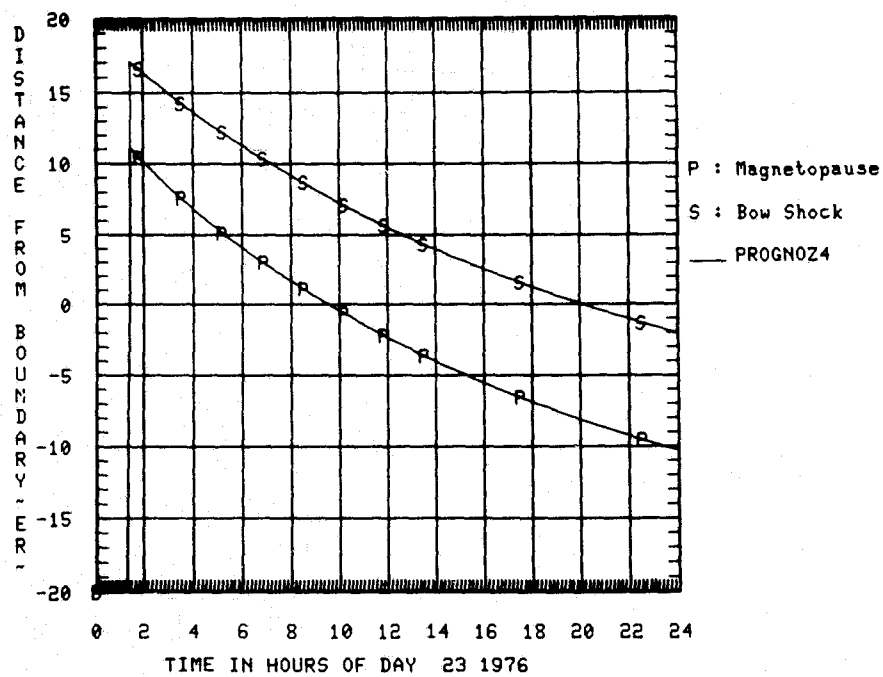
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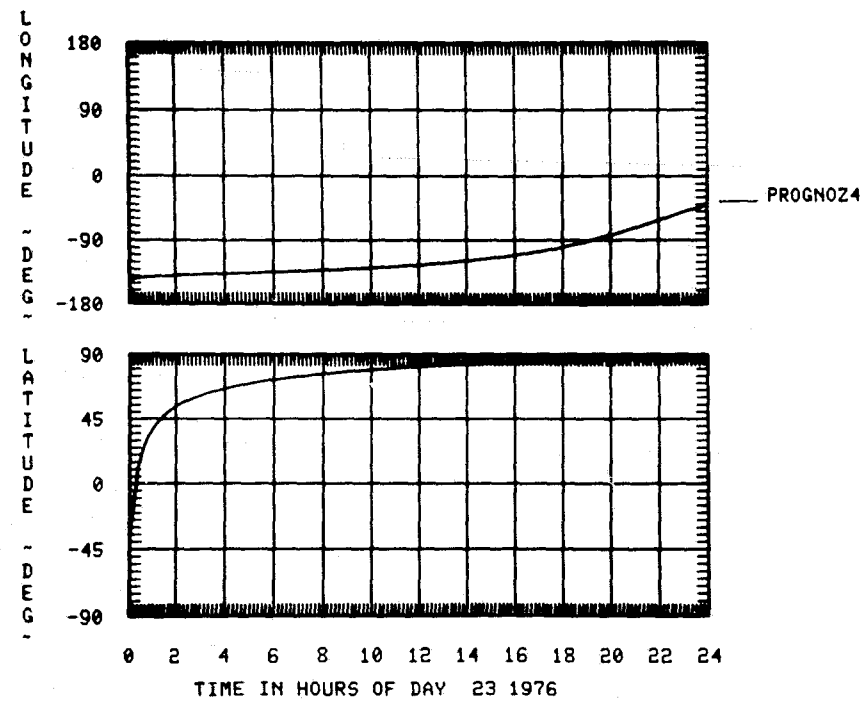
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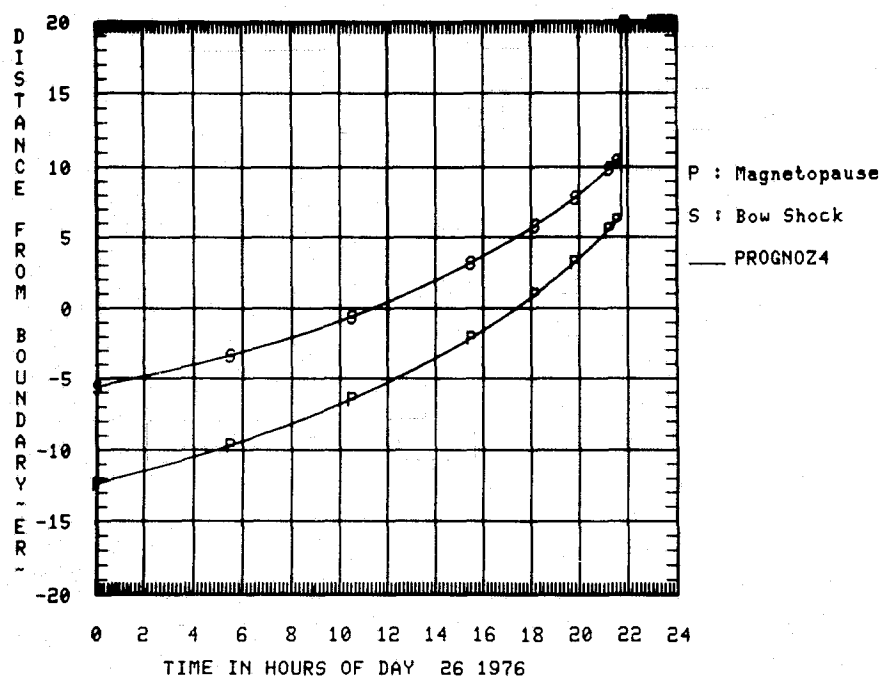
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ECLIPTIC POLAR COORDINATES



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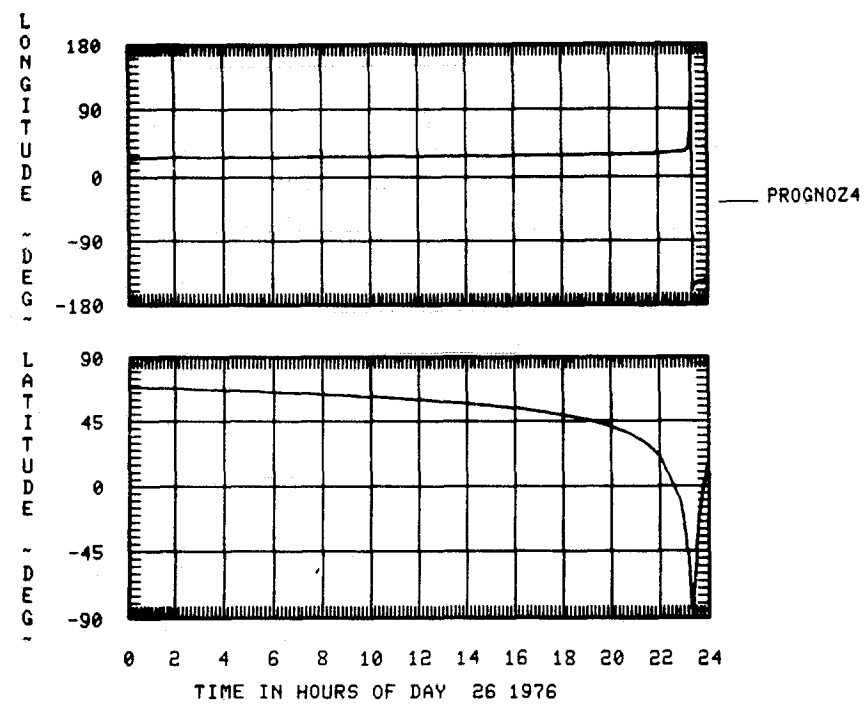
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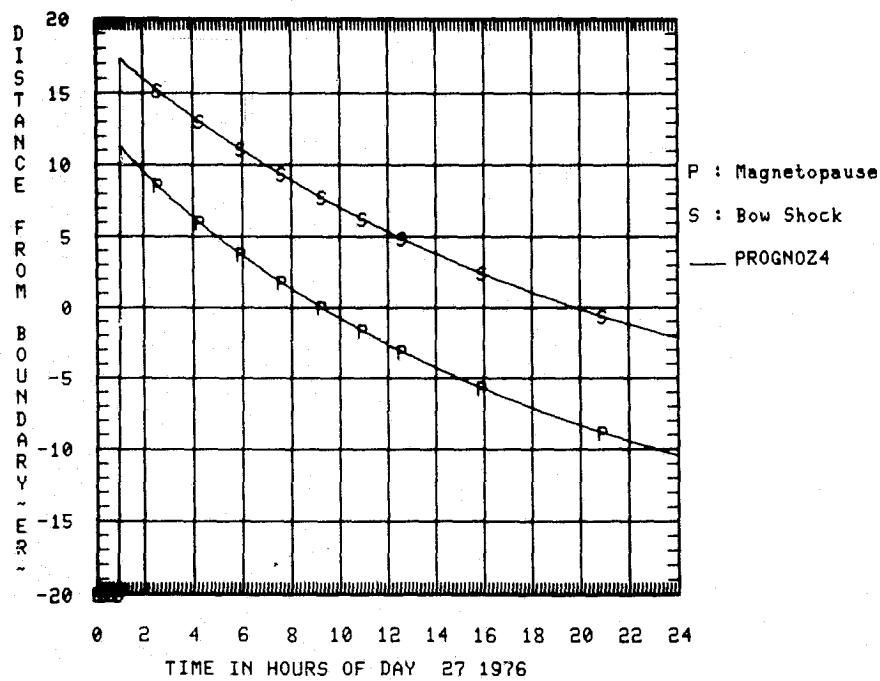
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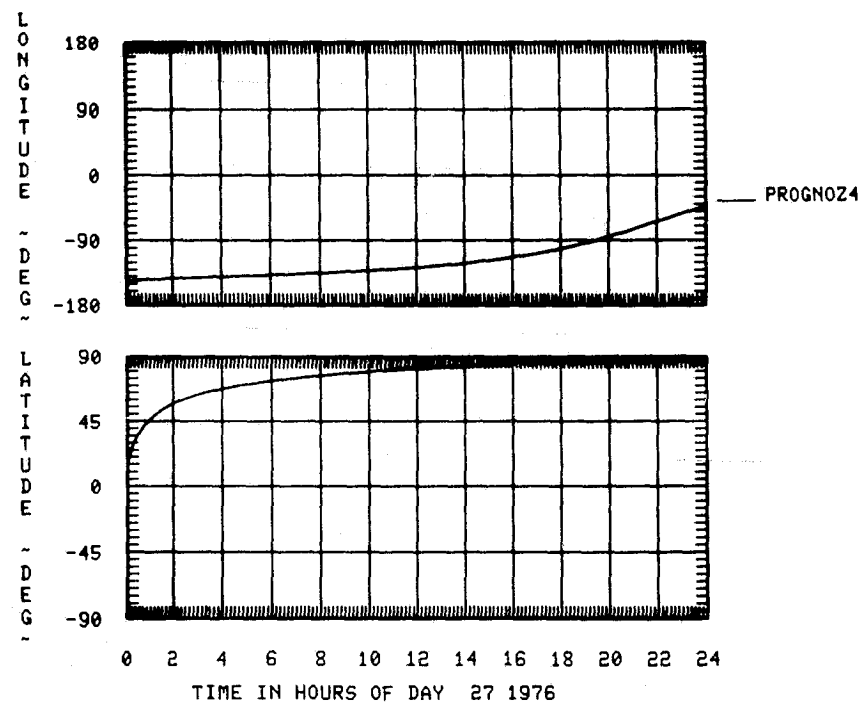
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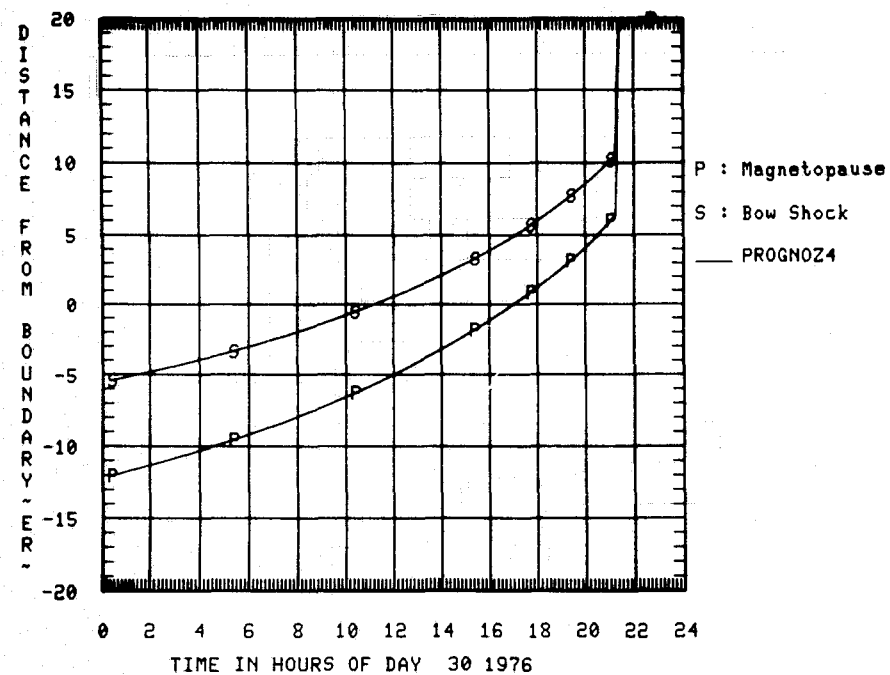
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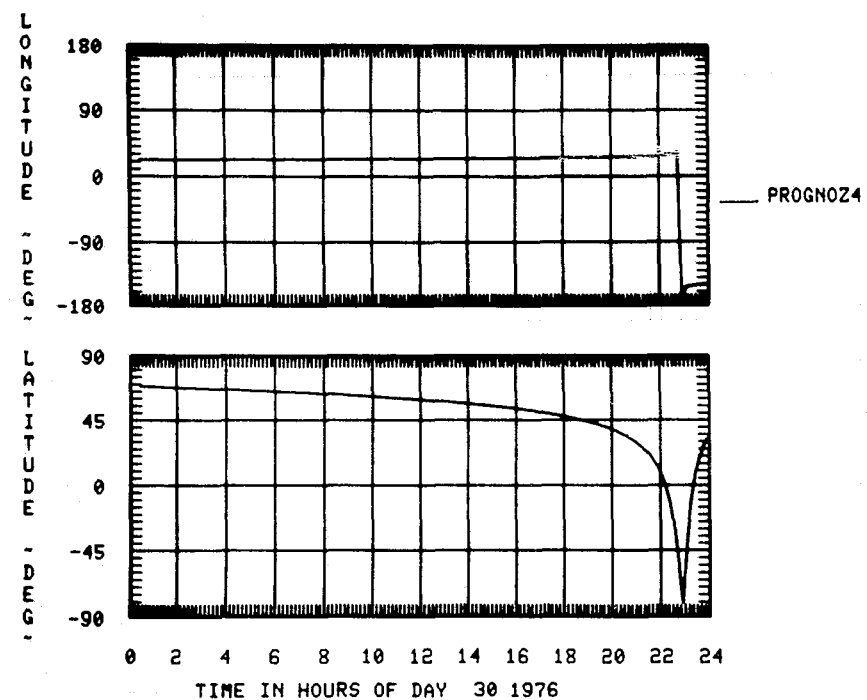
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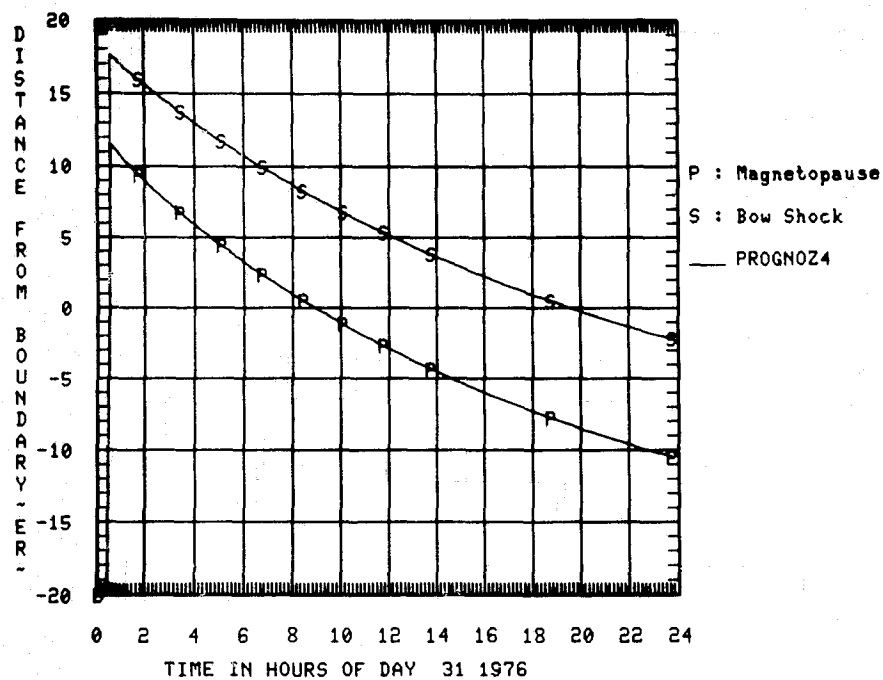
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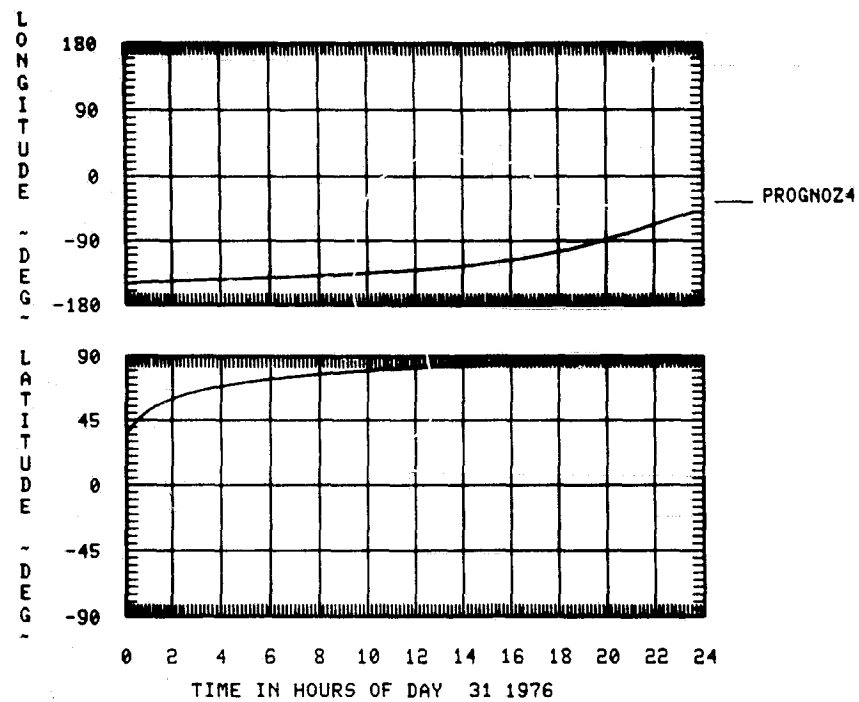
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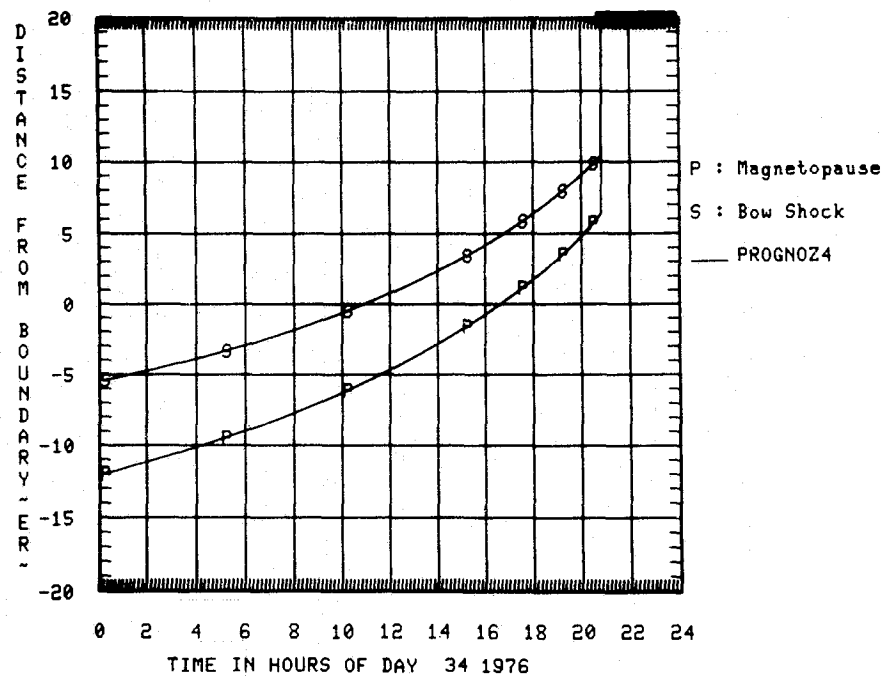
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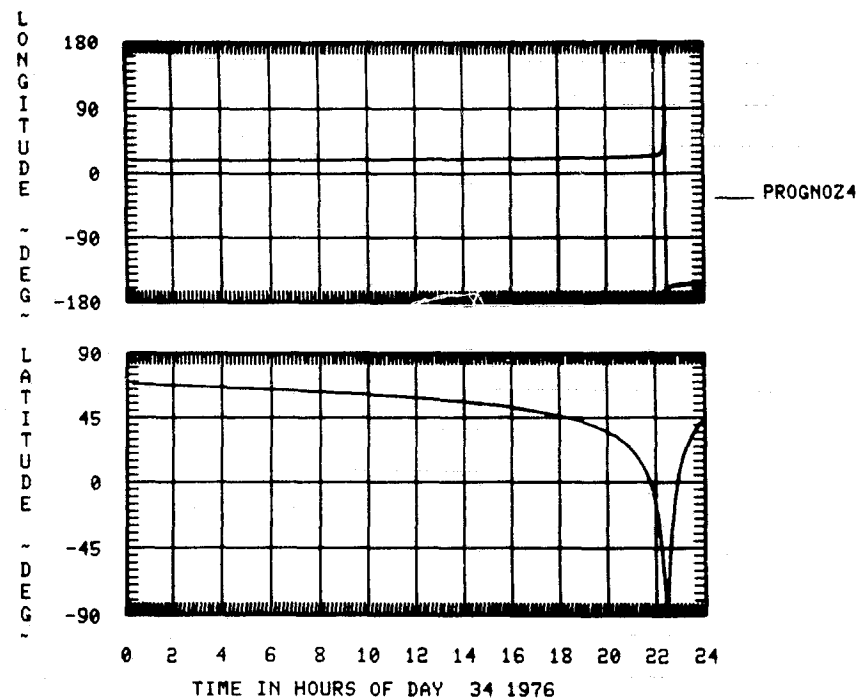
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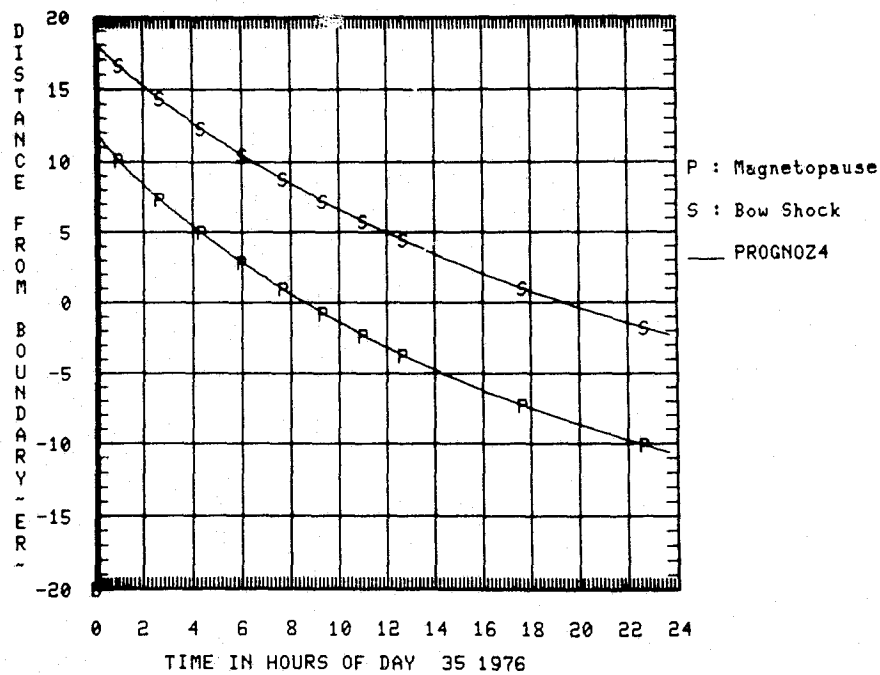
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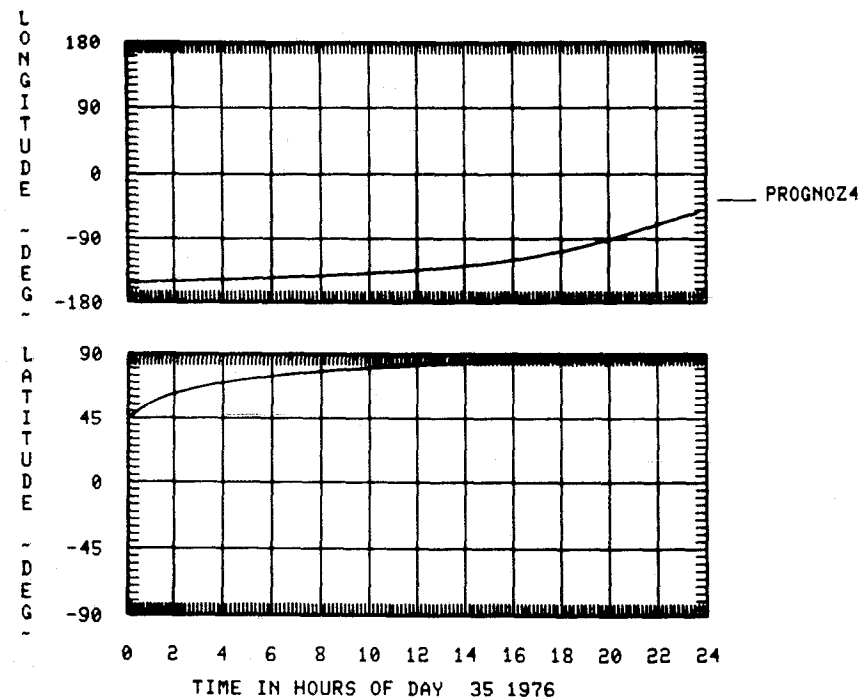
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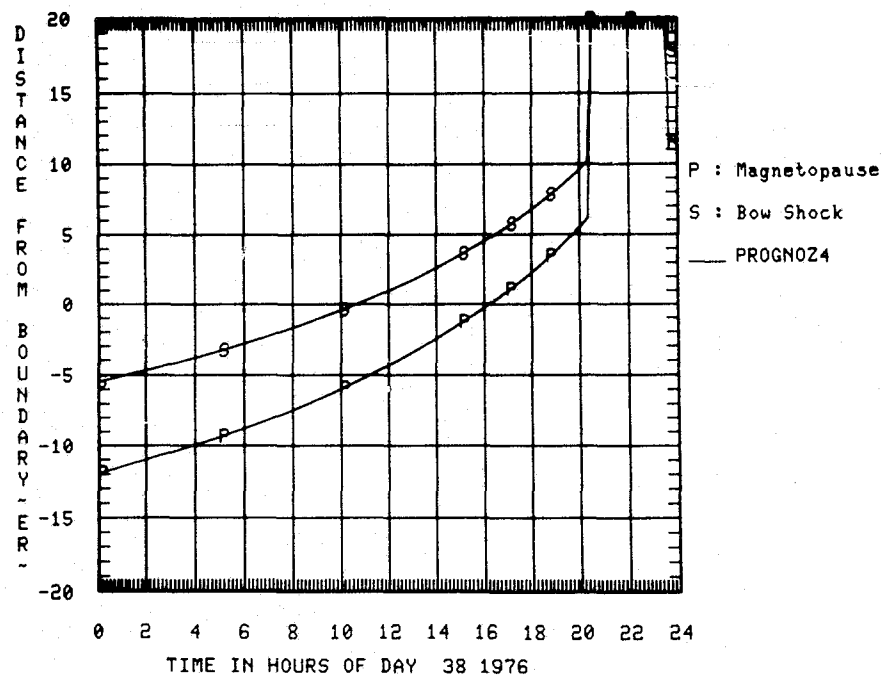
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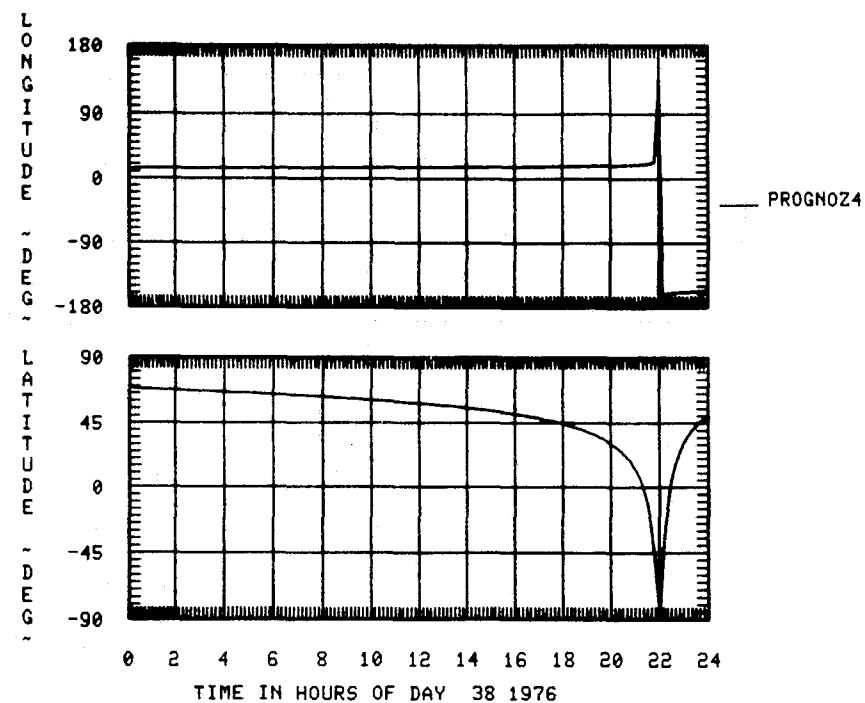
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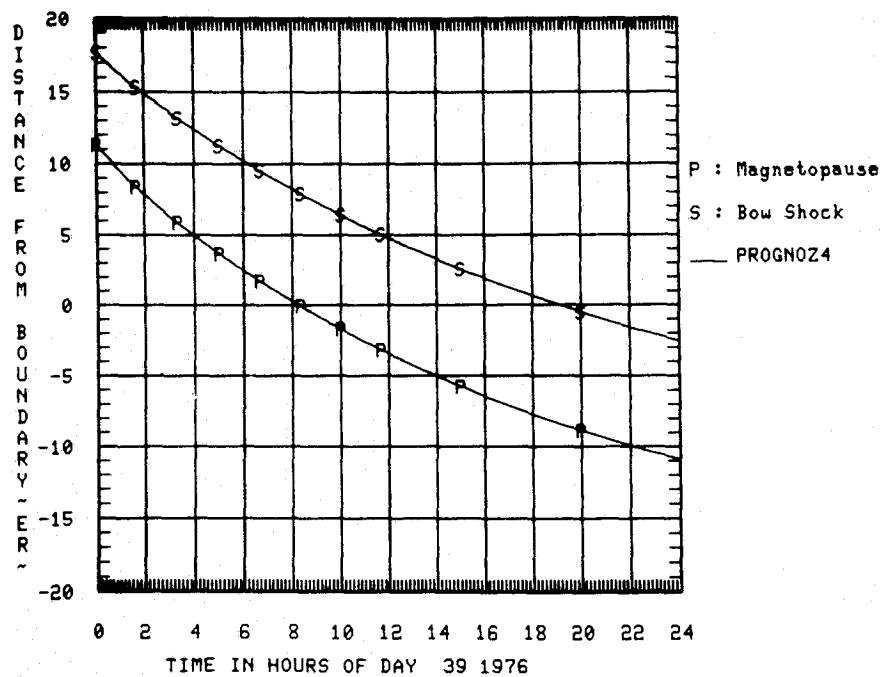
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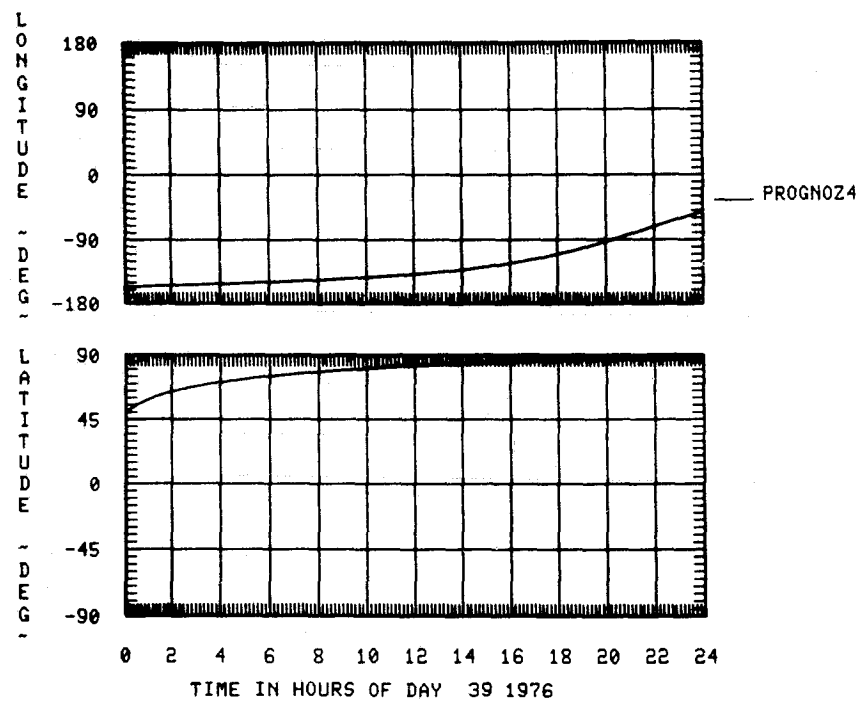
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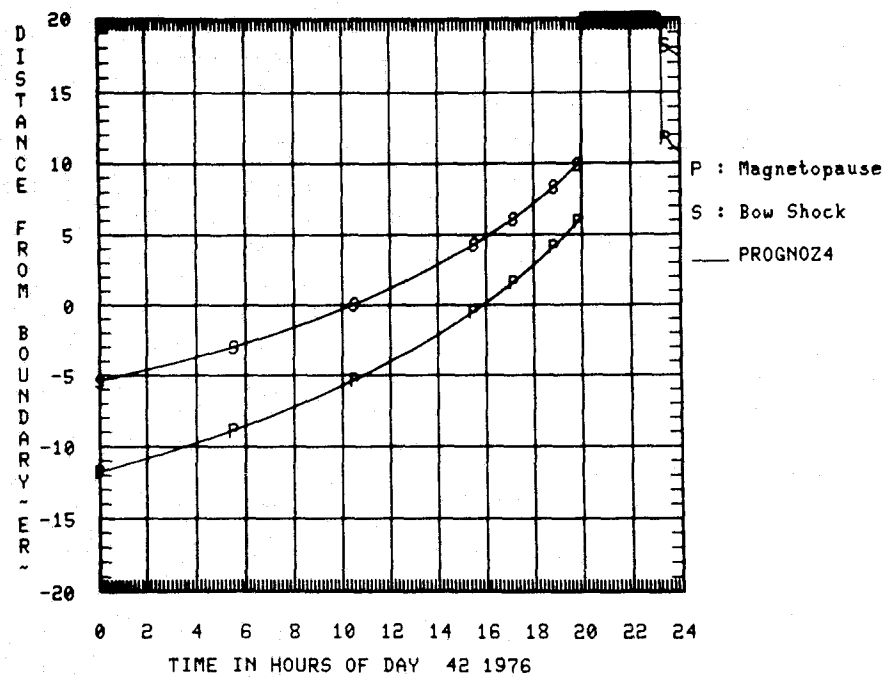
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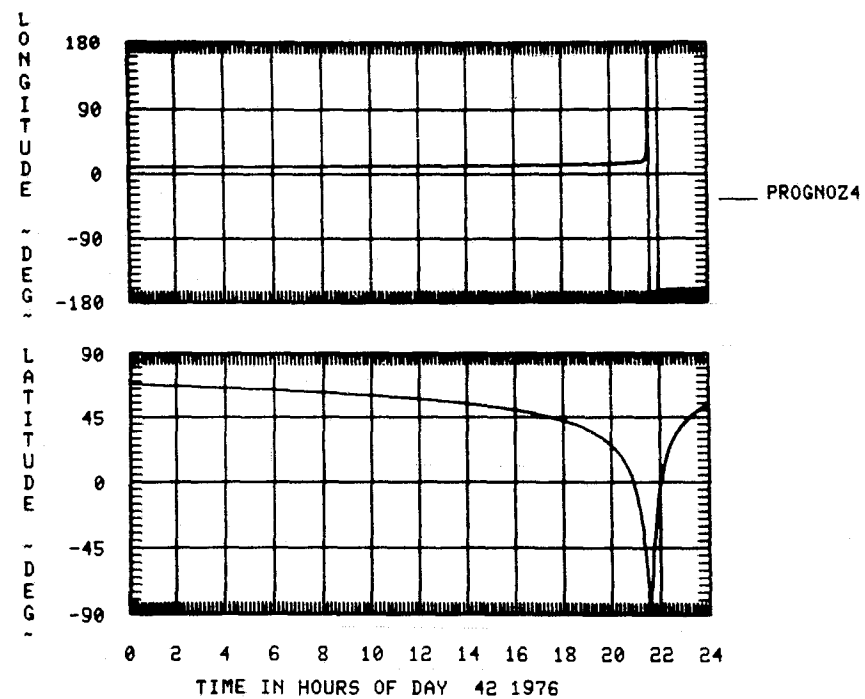
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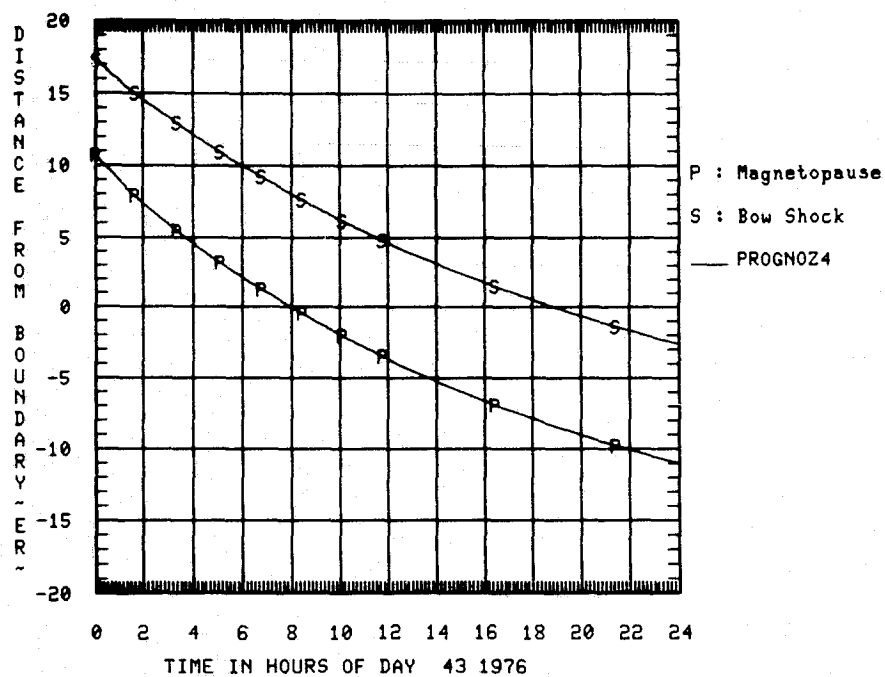
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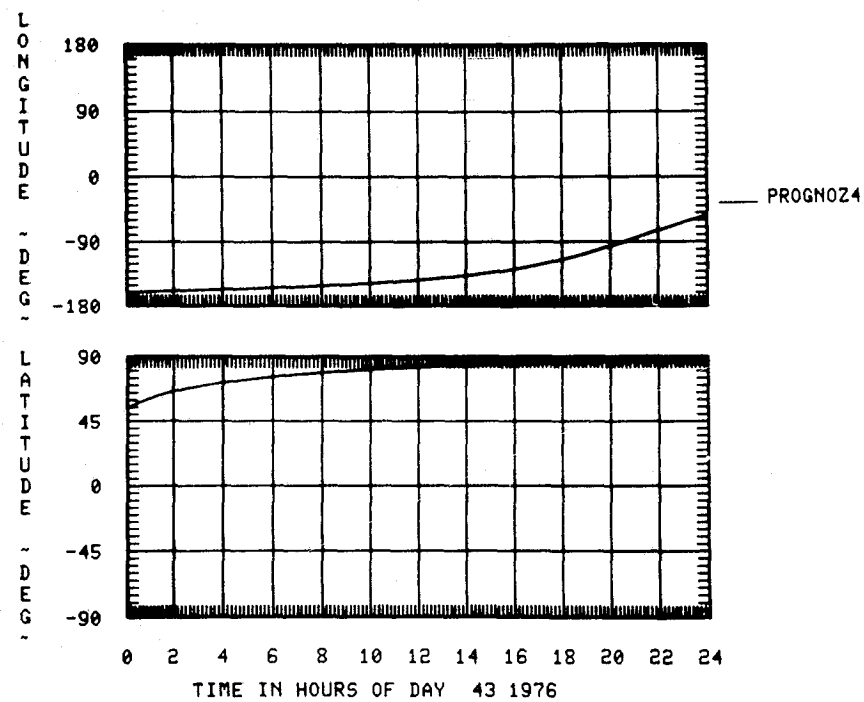
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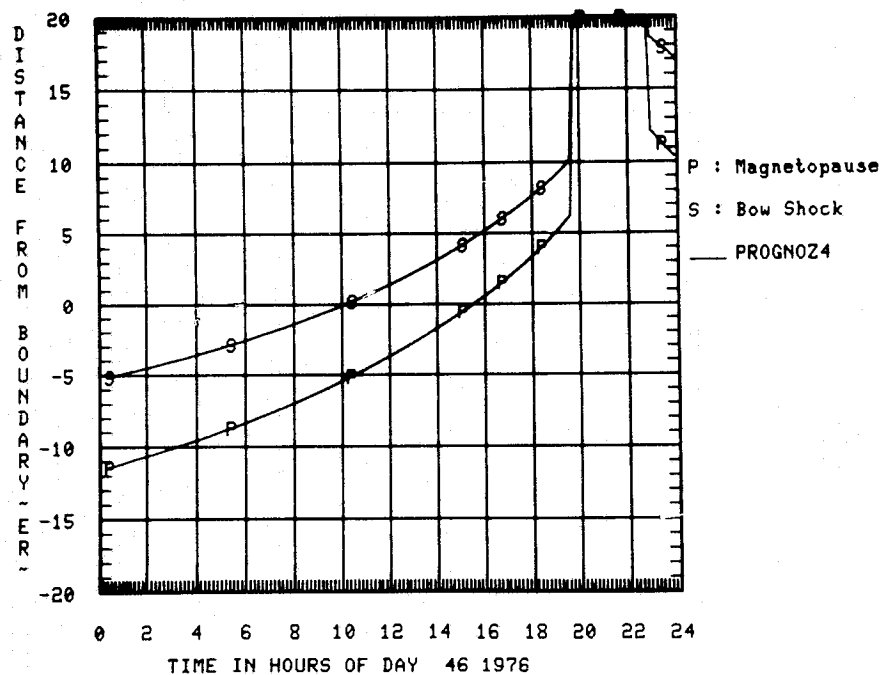
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ECLIPTIC POLAR COORDINATES



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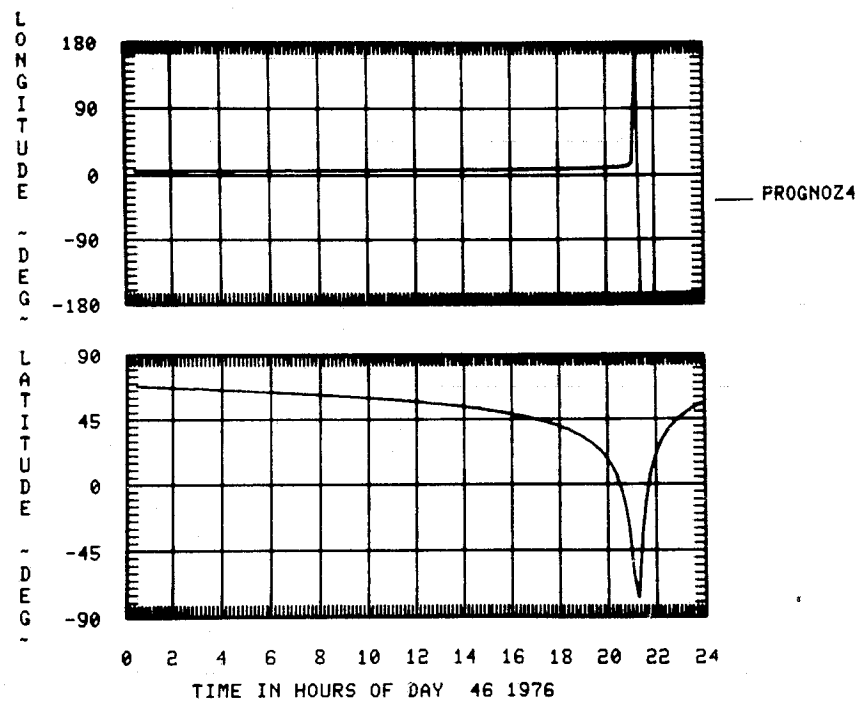
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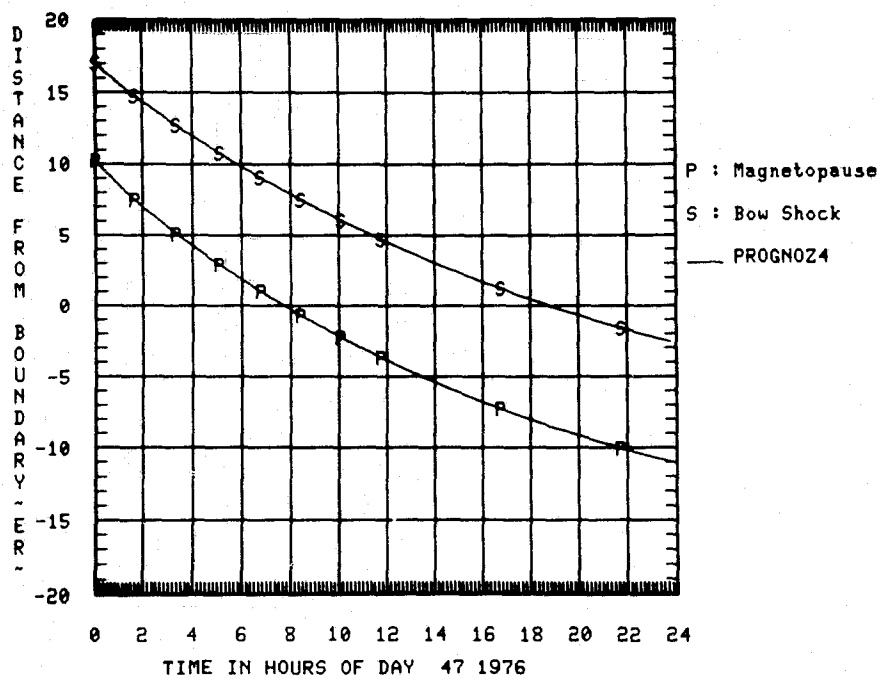
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ECLIPTIC POLAR COORDINATES



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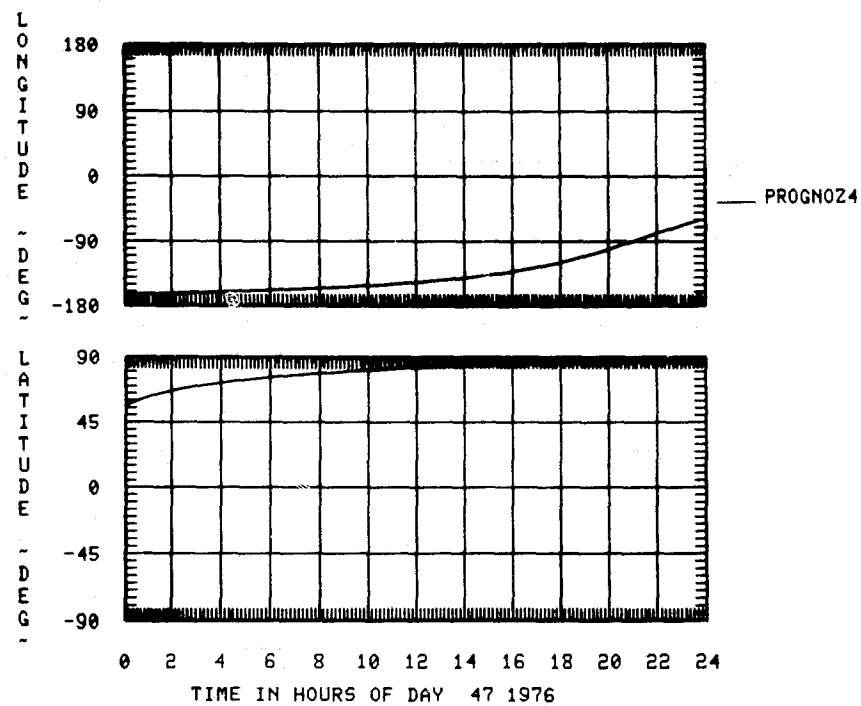
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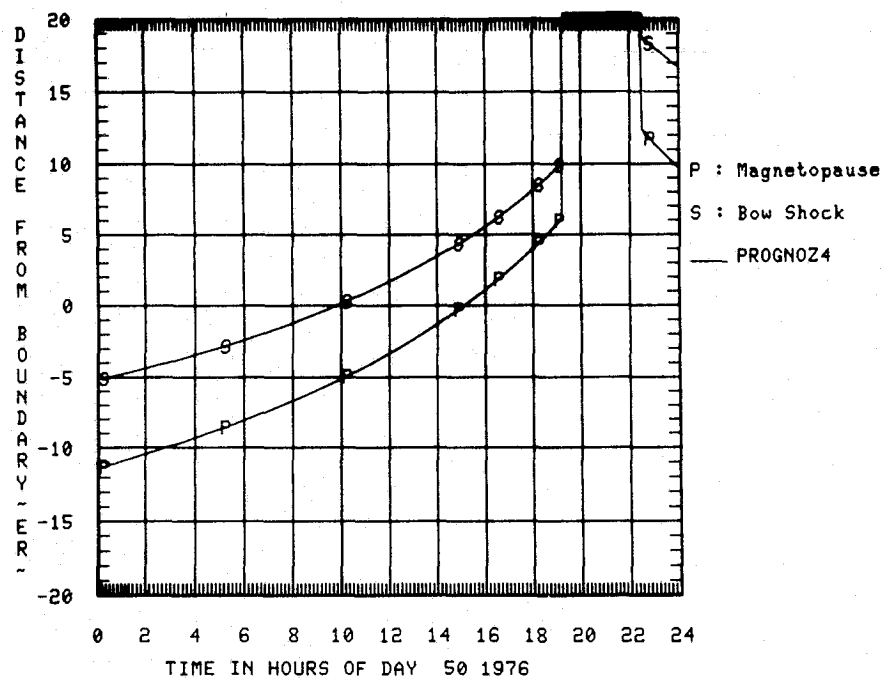
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ECLIPTIC POLAR COORDINATES



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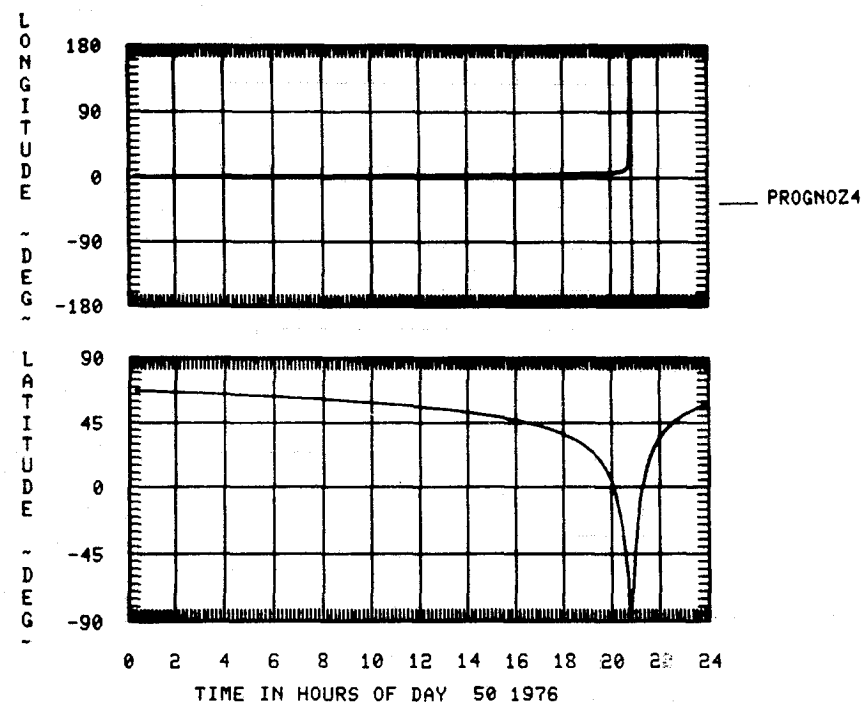
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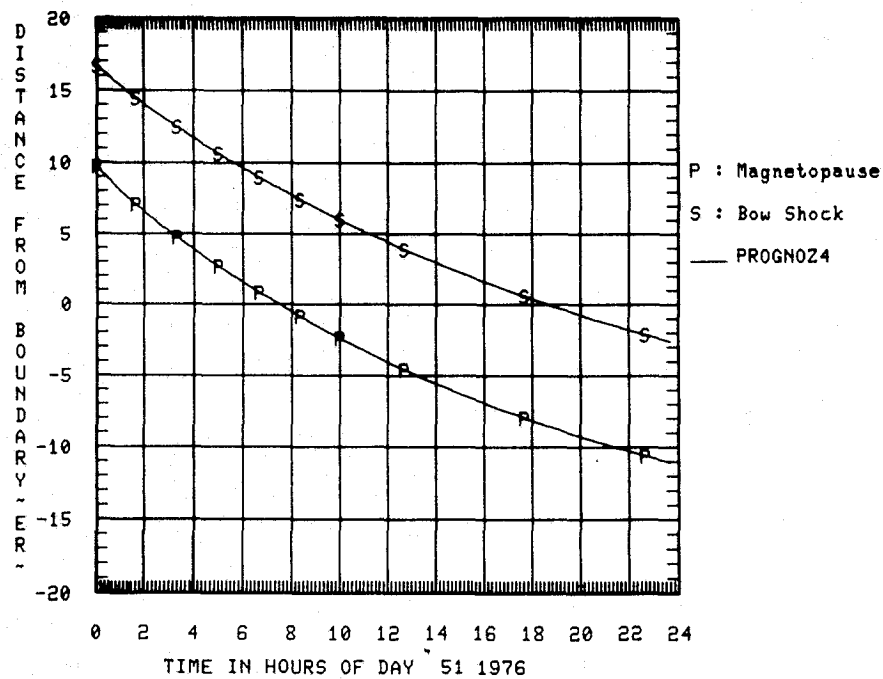
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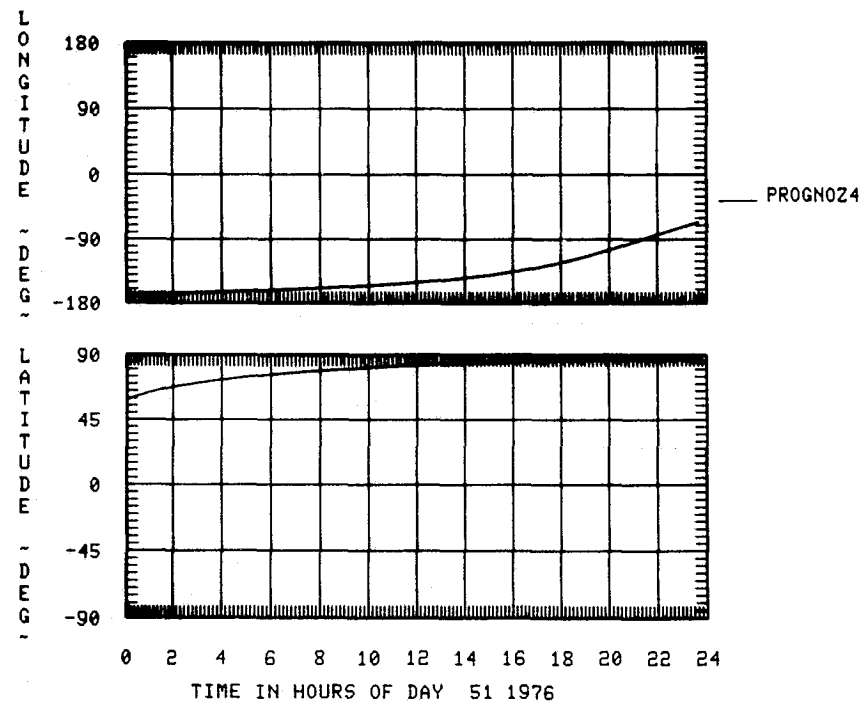
ECLIPTIC POLAR COORDINATES



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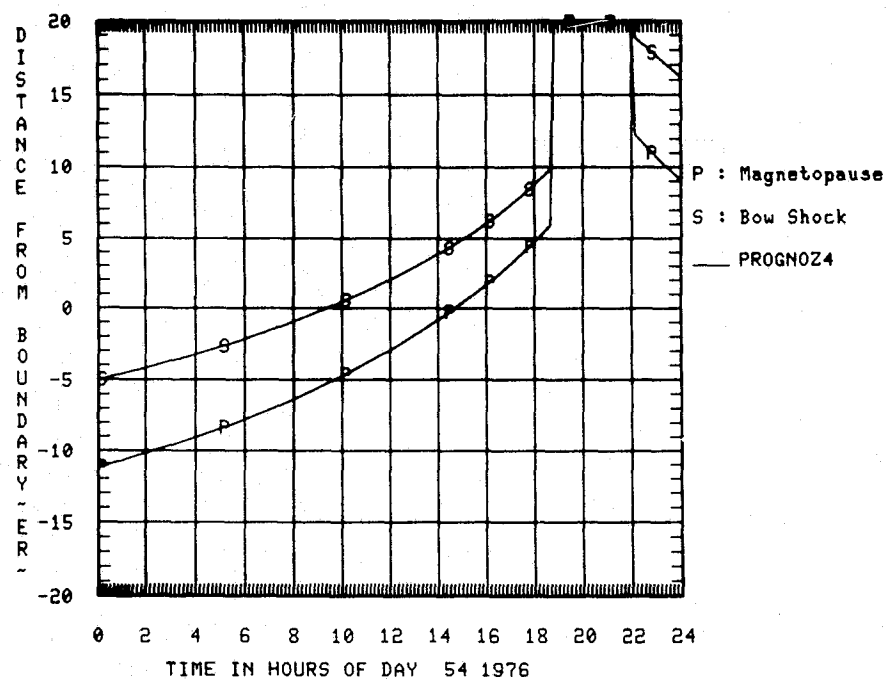


BOUNDARY PLOT
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ECLIPTIC POLAR COORDINATES



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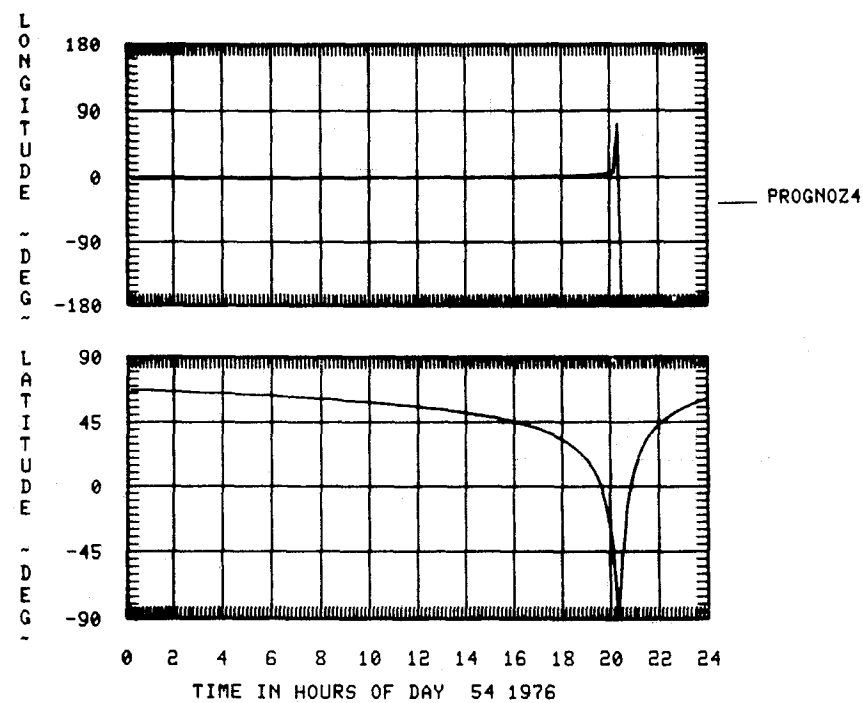
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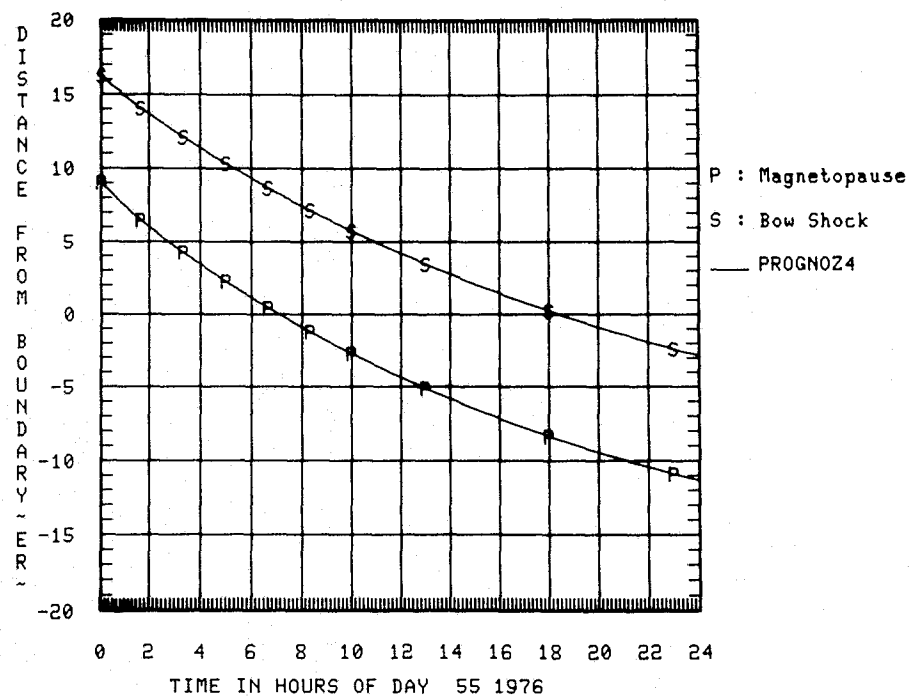
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ECLIPTIC POLAR COORDINATES



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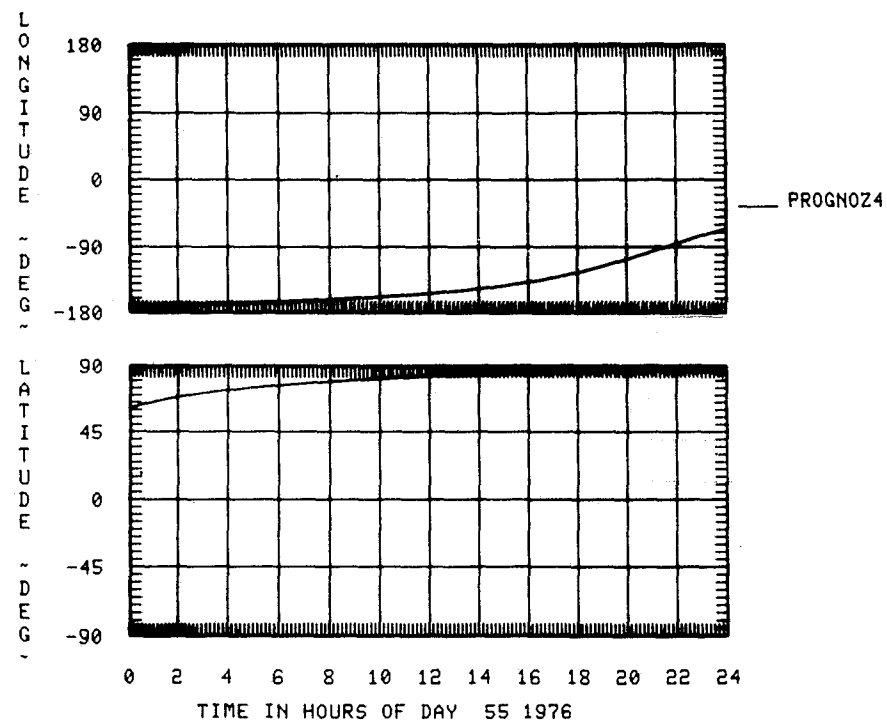
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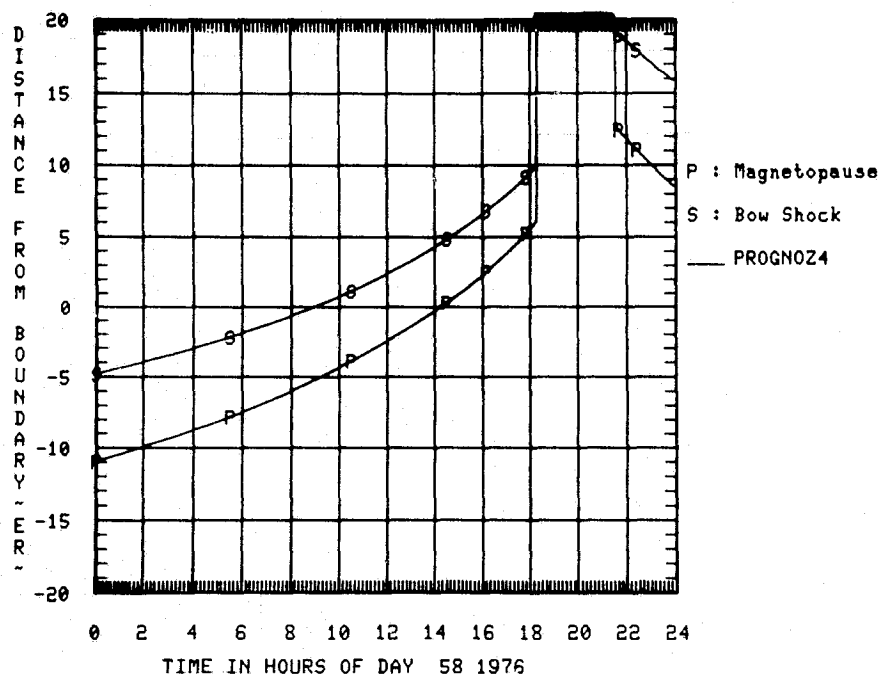
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ECLIPTIC POLAR COORDINATES



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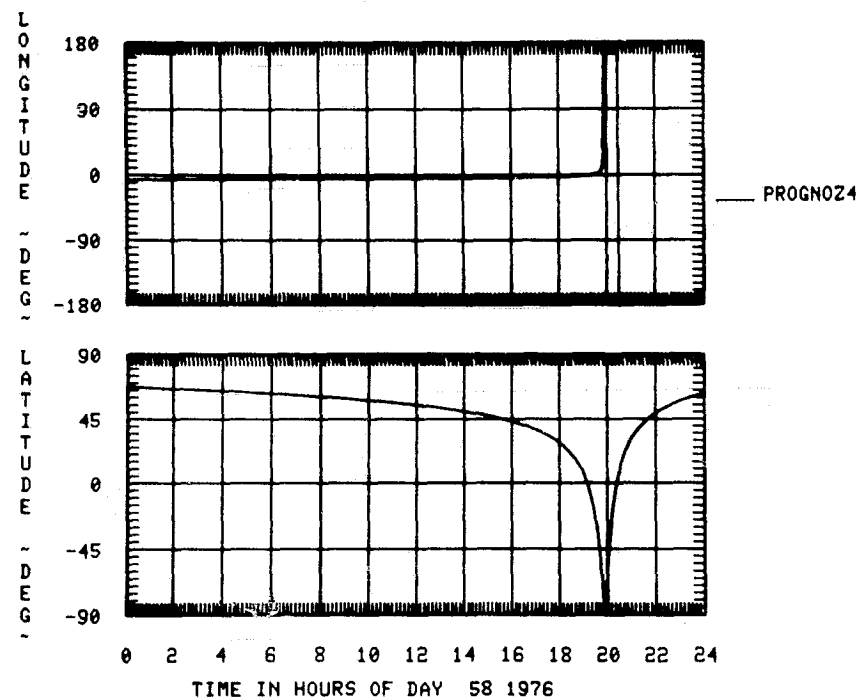
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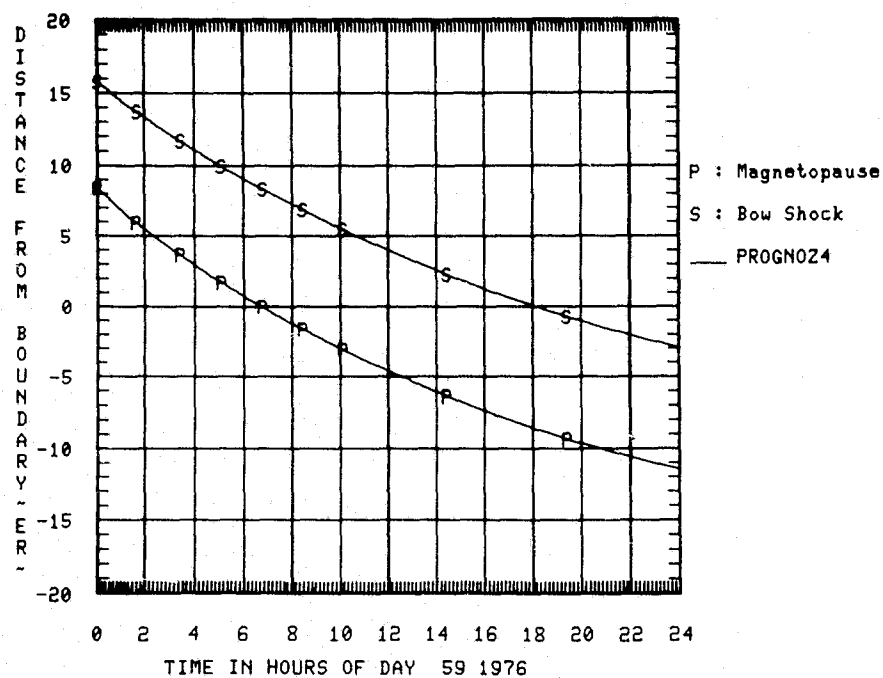
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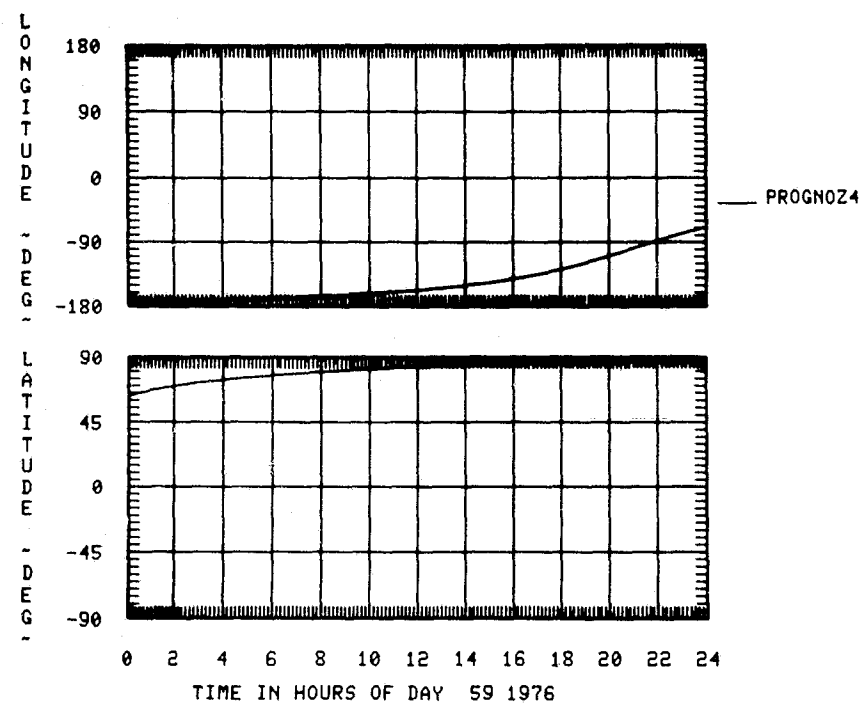
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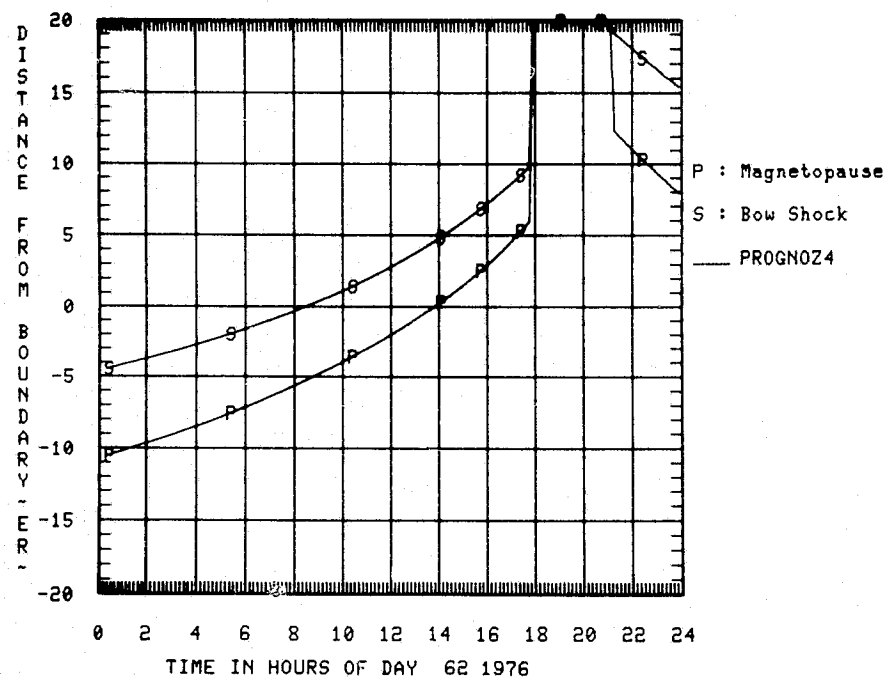
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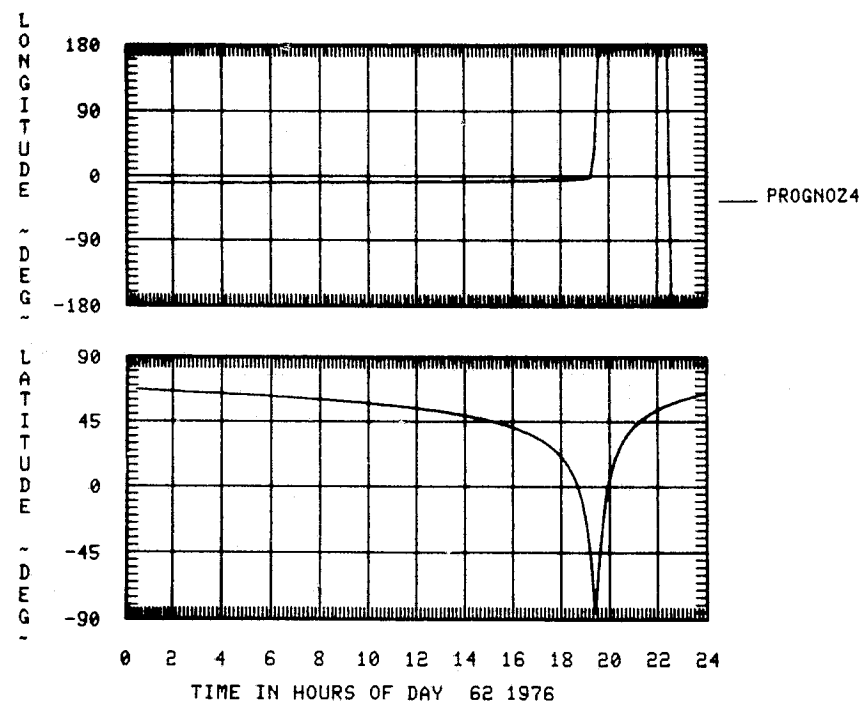
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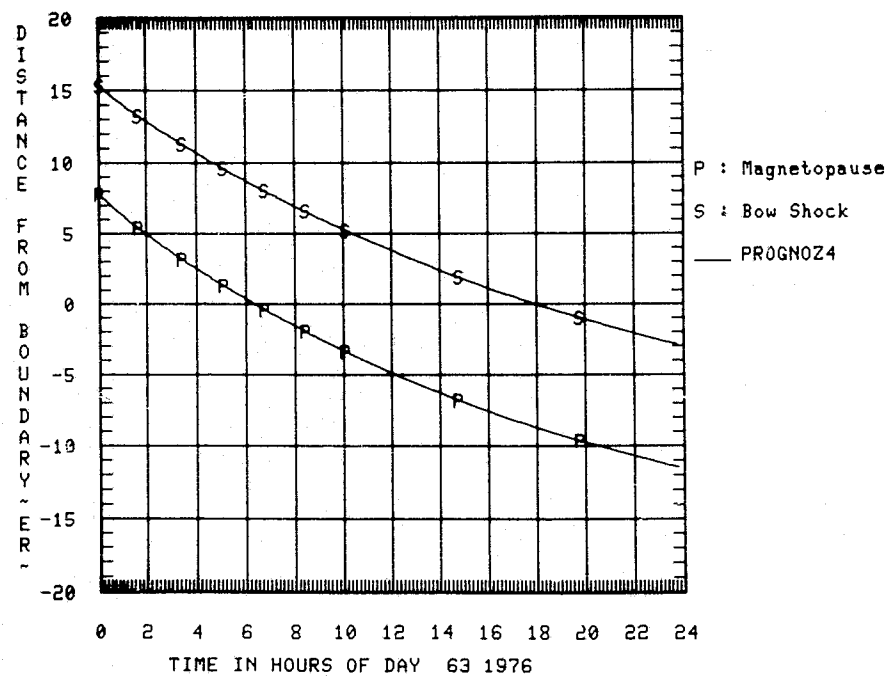
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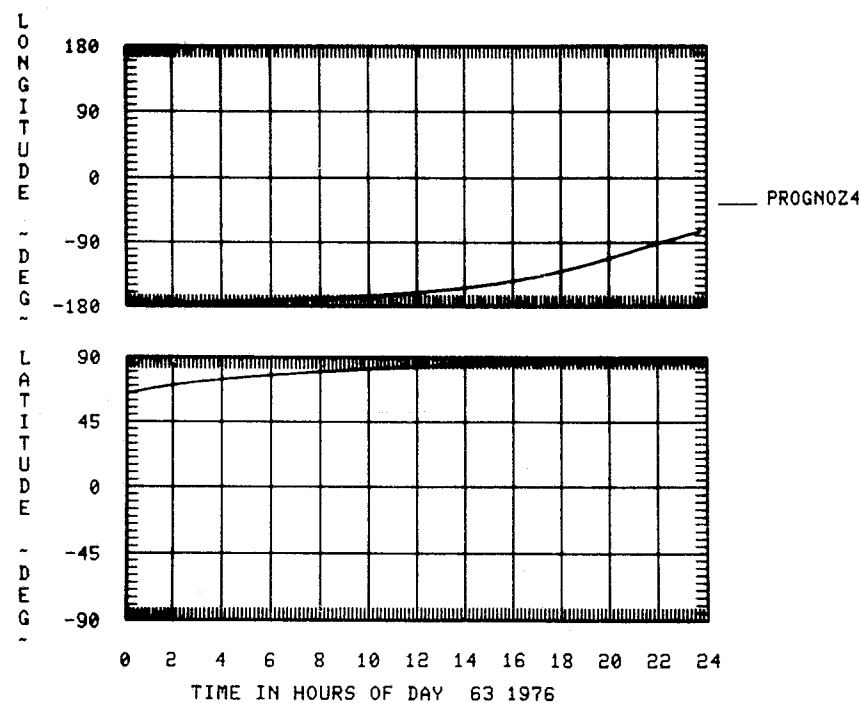
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ECLIPTIC POLAR COORDINATES



BOUNDARY PLOT
SAT ID: PROGNOZ4

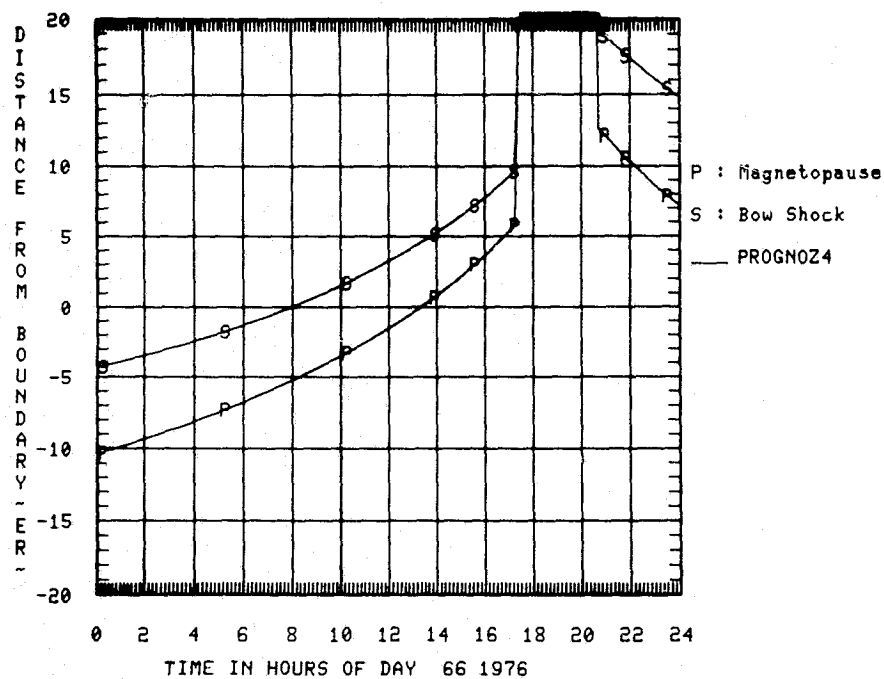


BOUNDARY PLOT
SAT ID: PROGNOZ4
ECLIPTIC POLAR COORDINATES



BOUNDARY PLOT

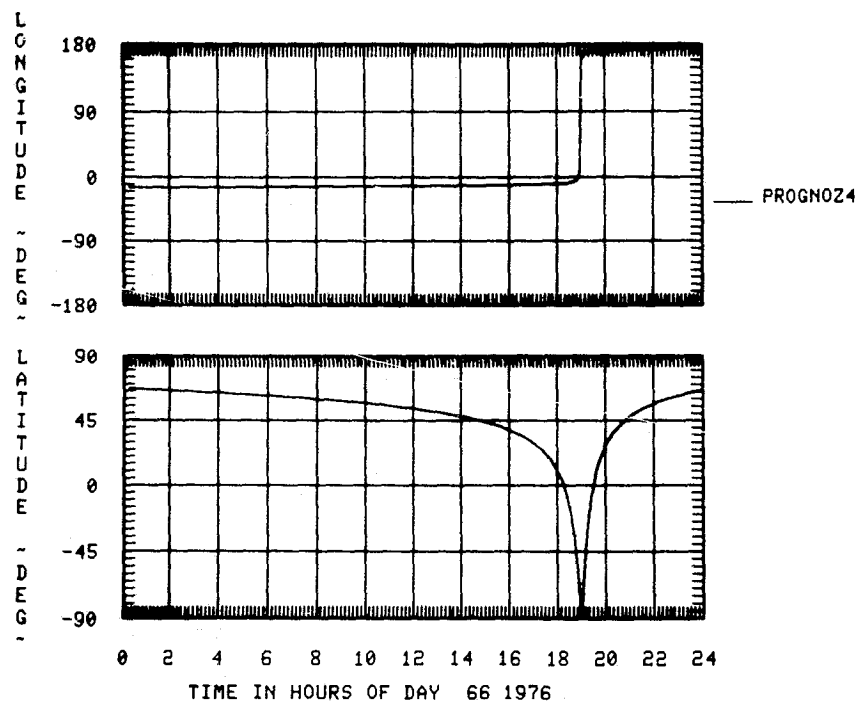
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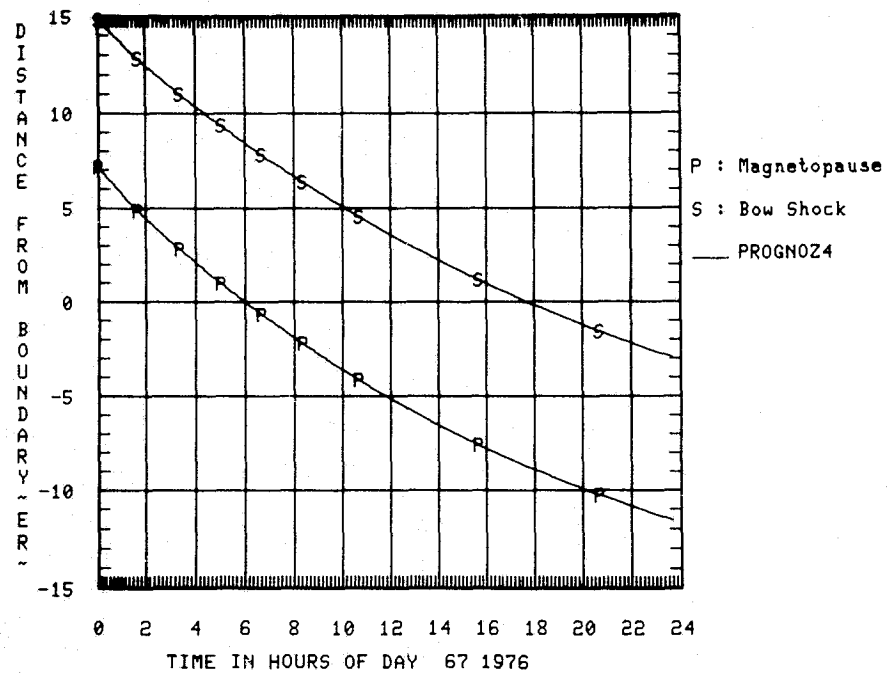
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ECLIPTIC POLAR COORDINATES



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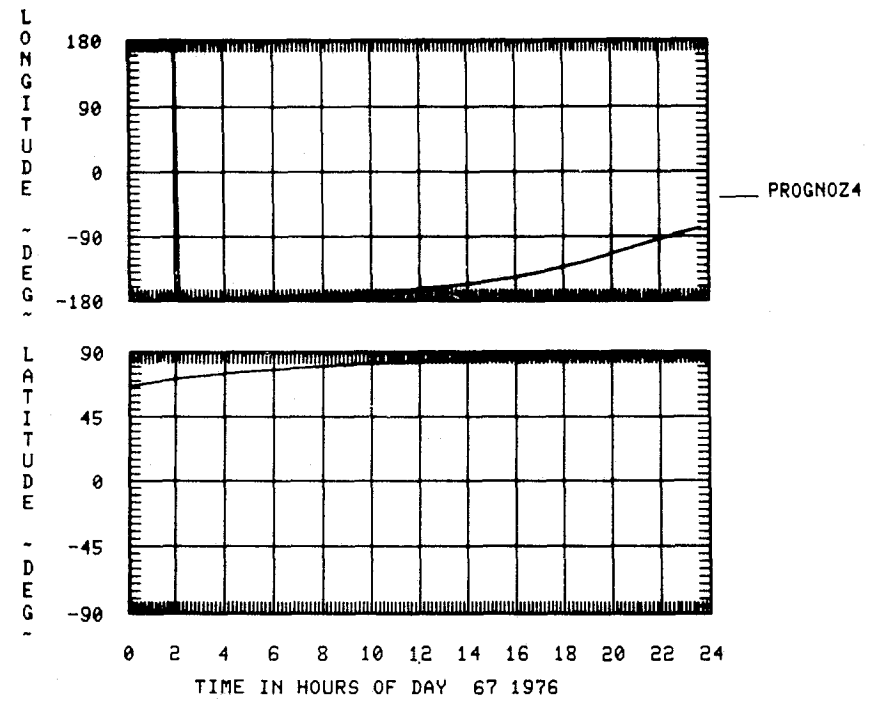
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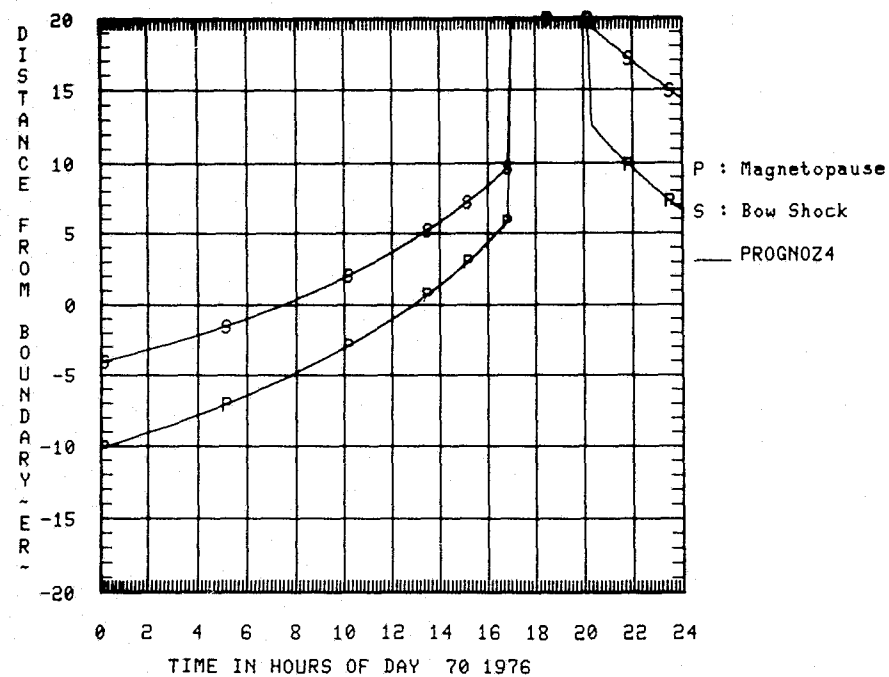
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ECLIPTIC POLAR COORDINATES



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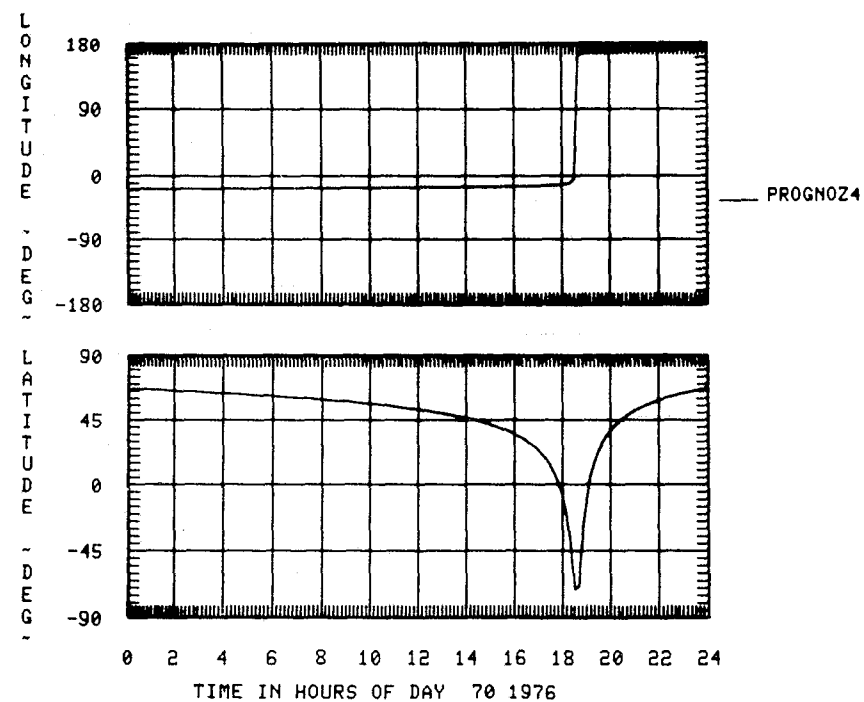
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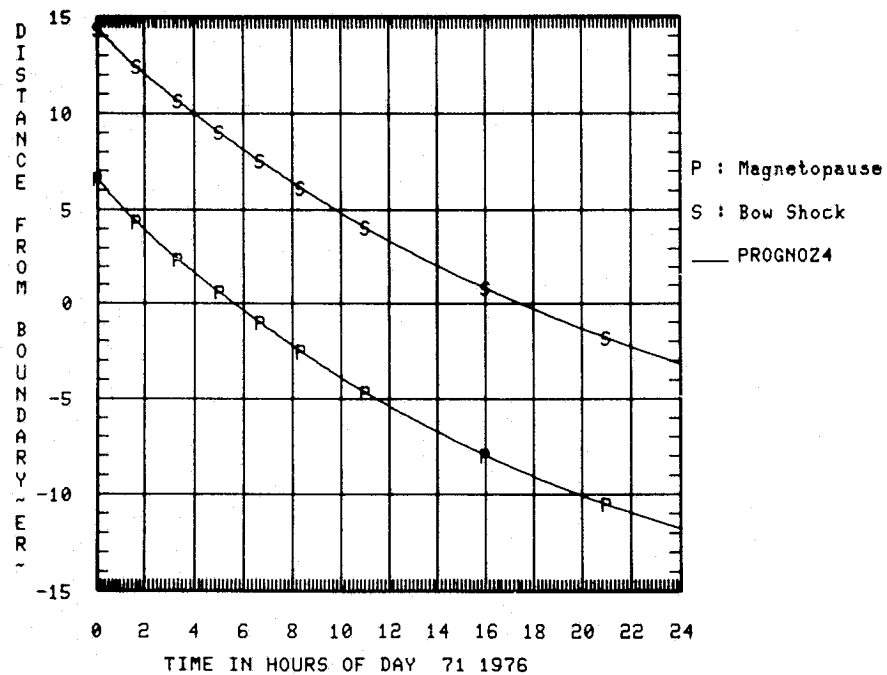
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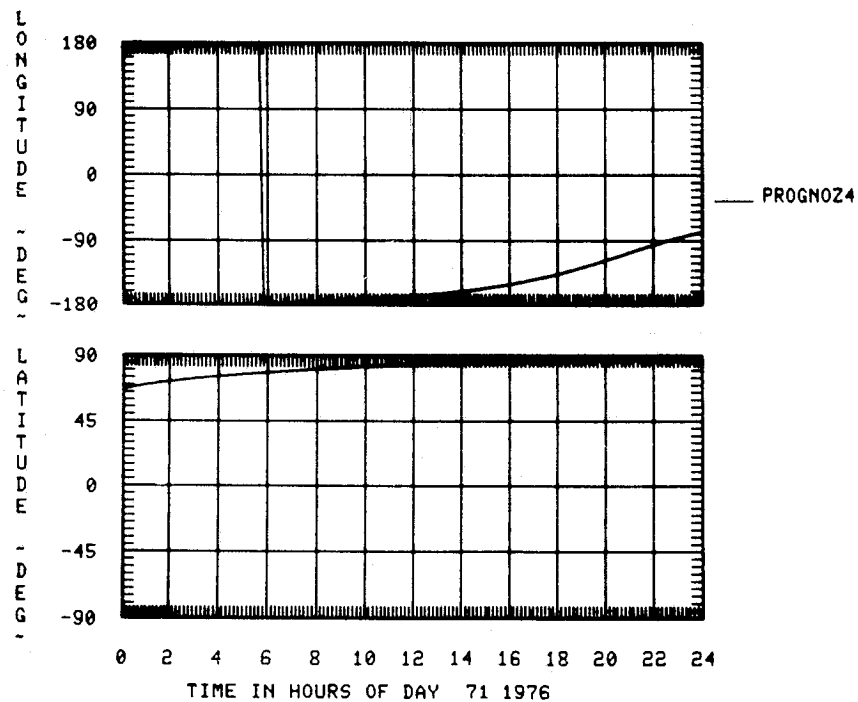
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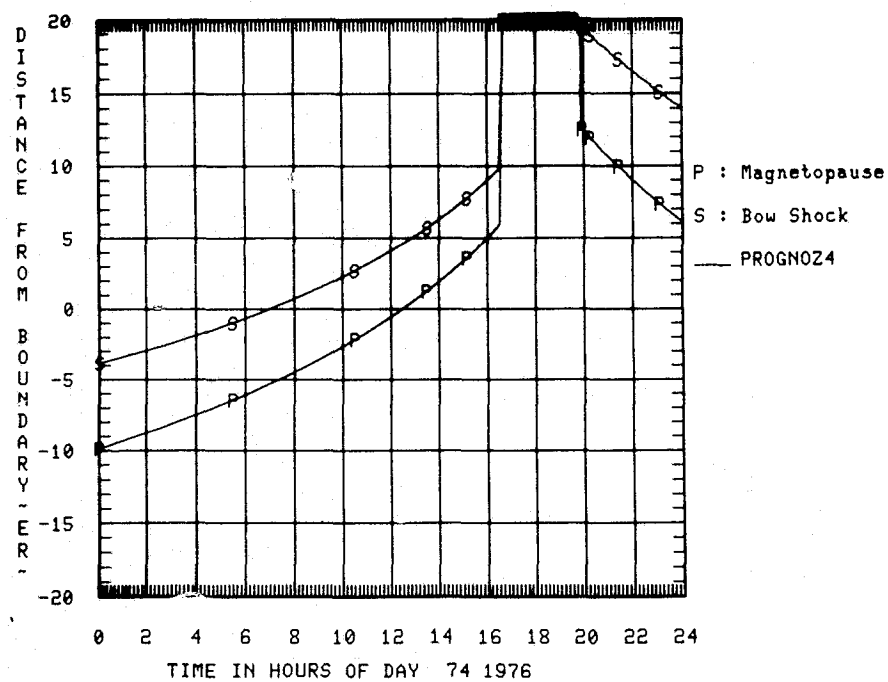
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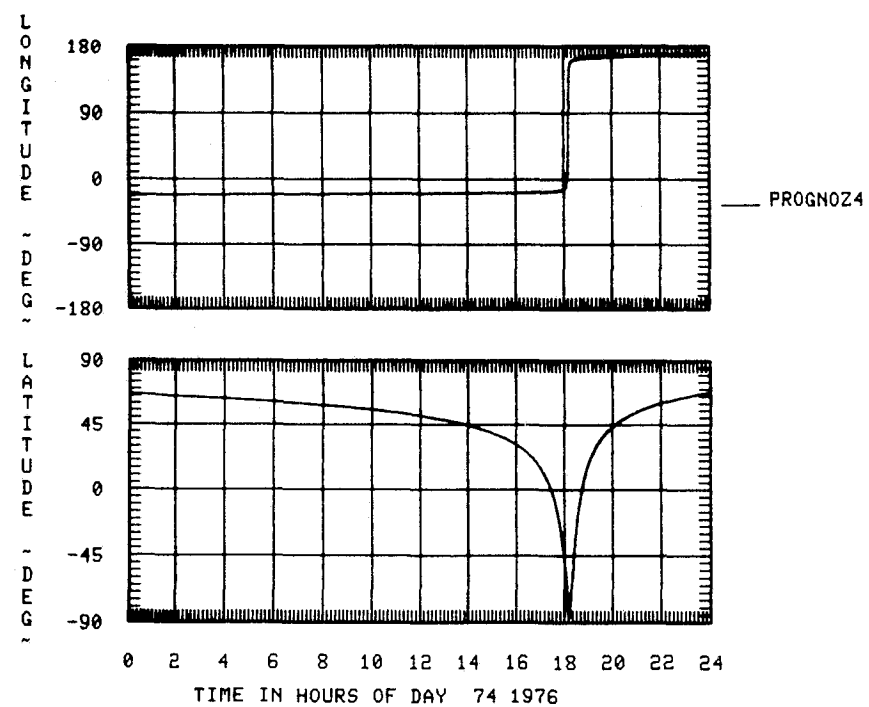
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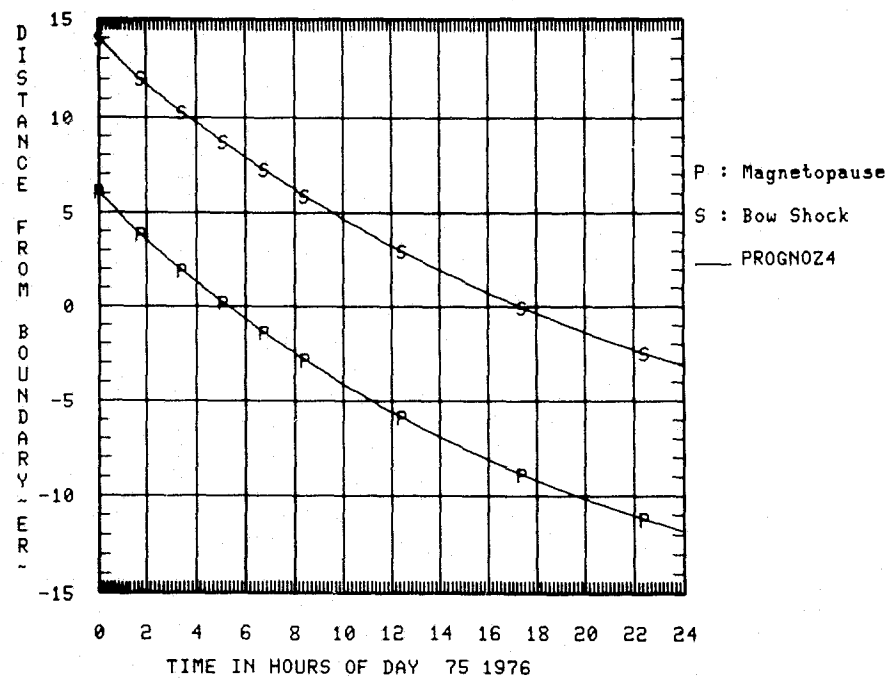
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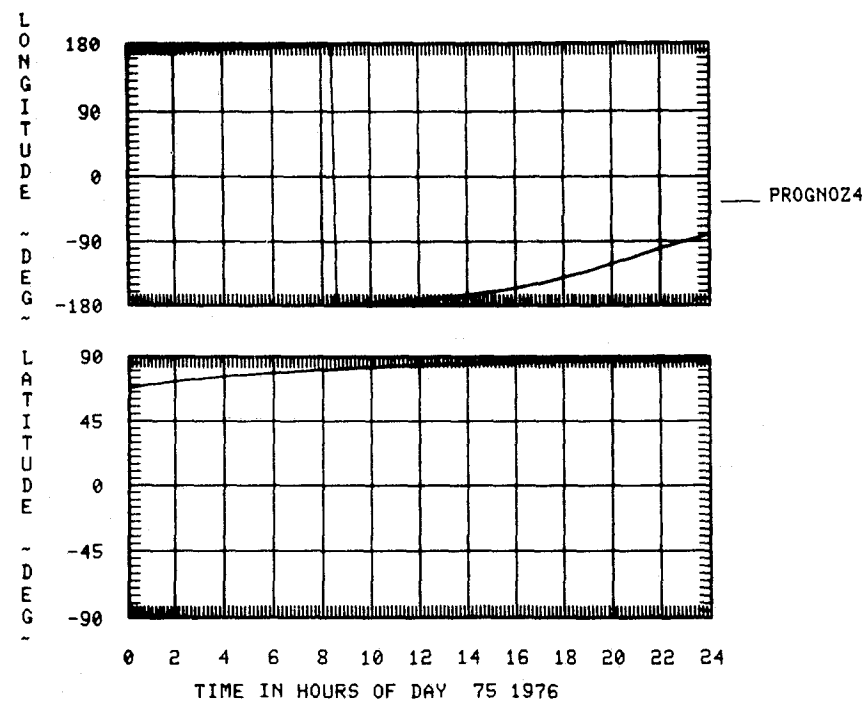
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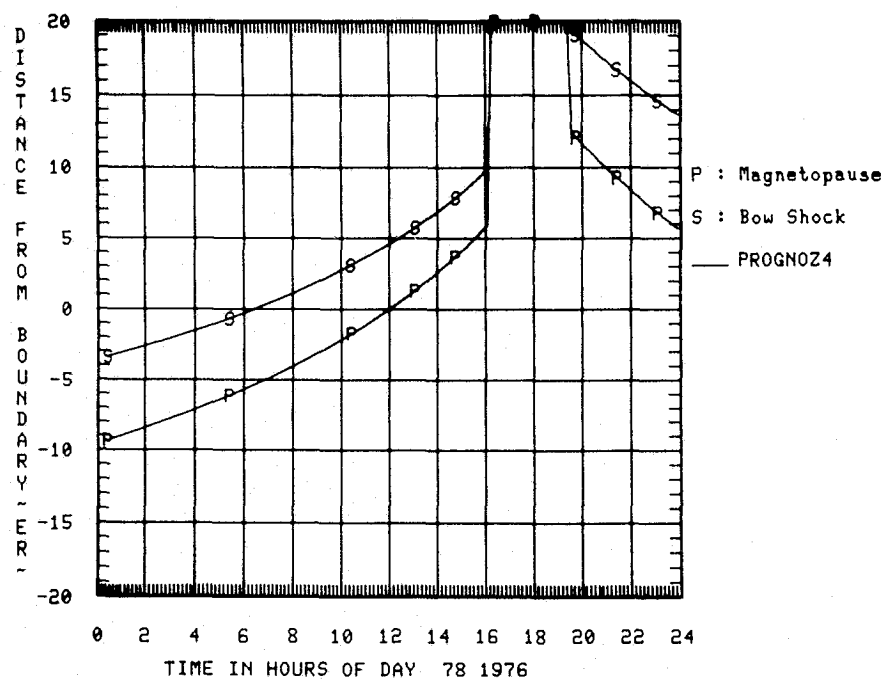
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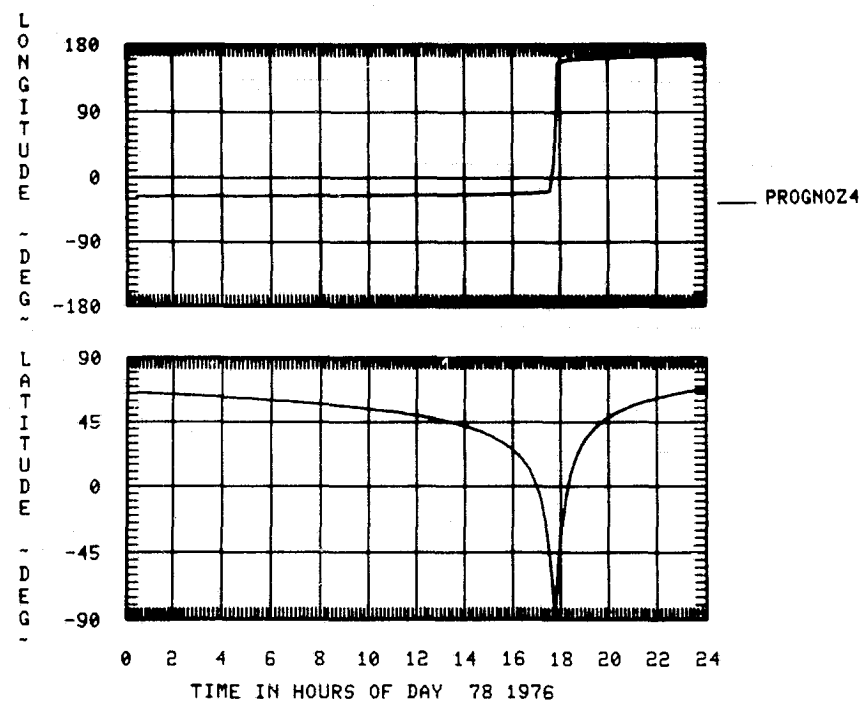
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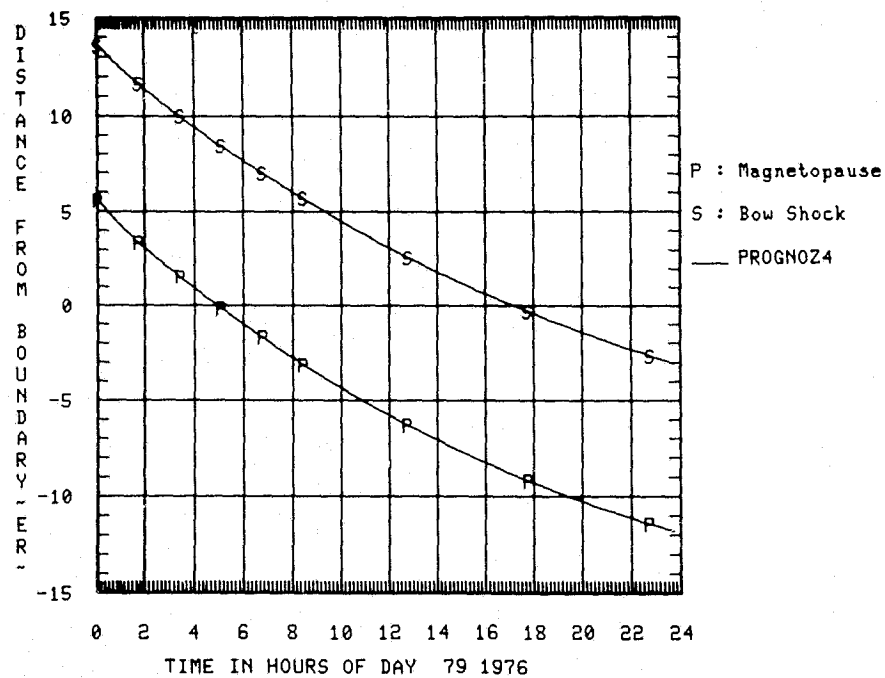
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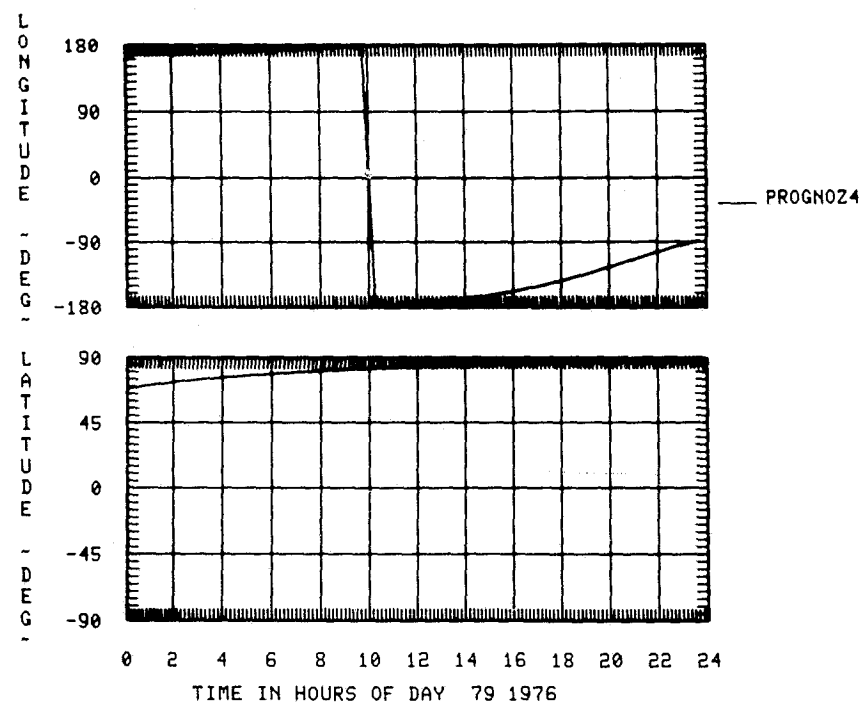
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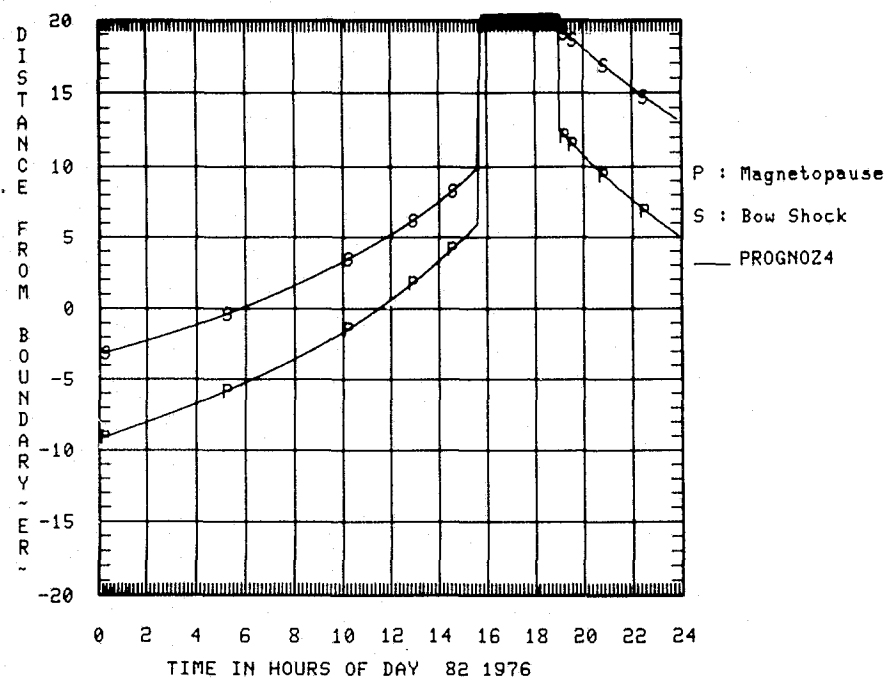
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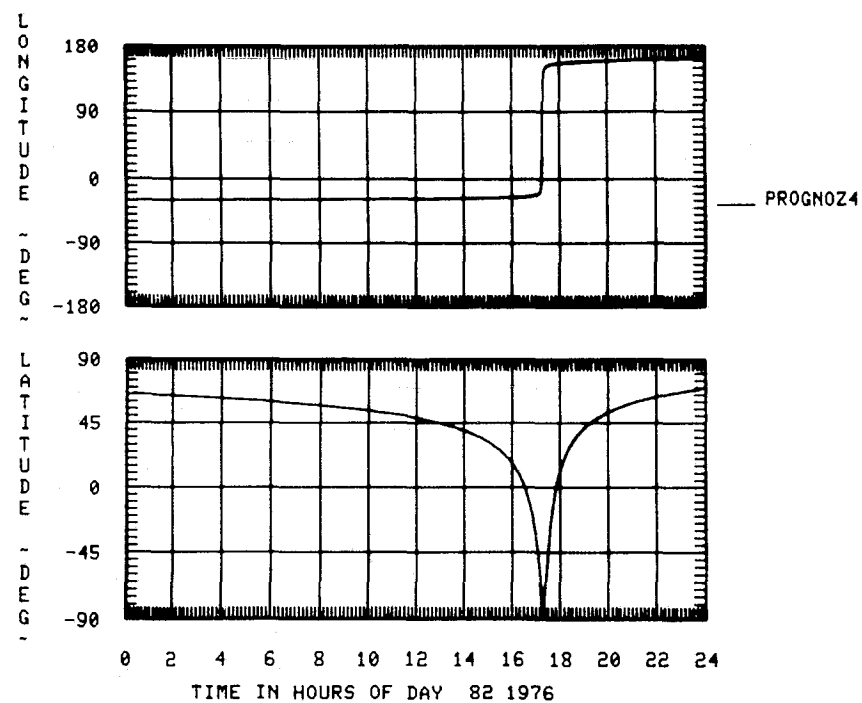
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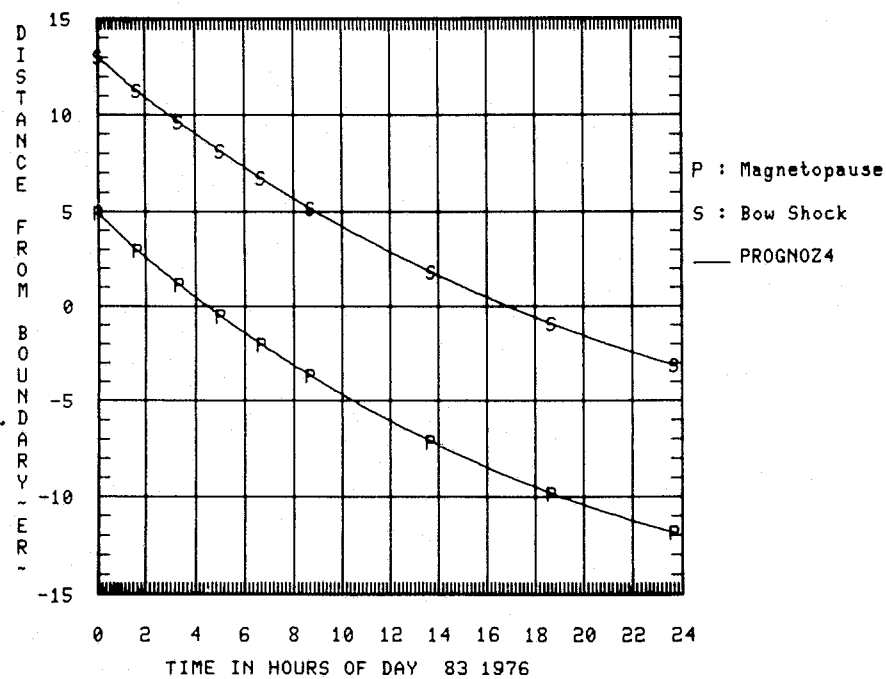


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ECLIPTIC POLAR COORDINATES



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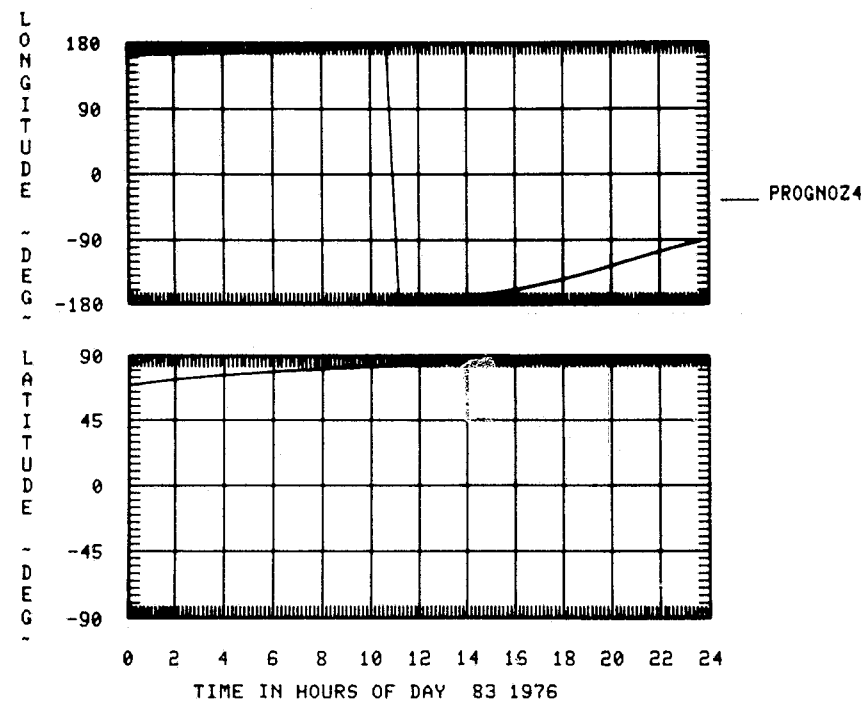
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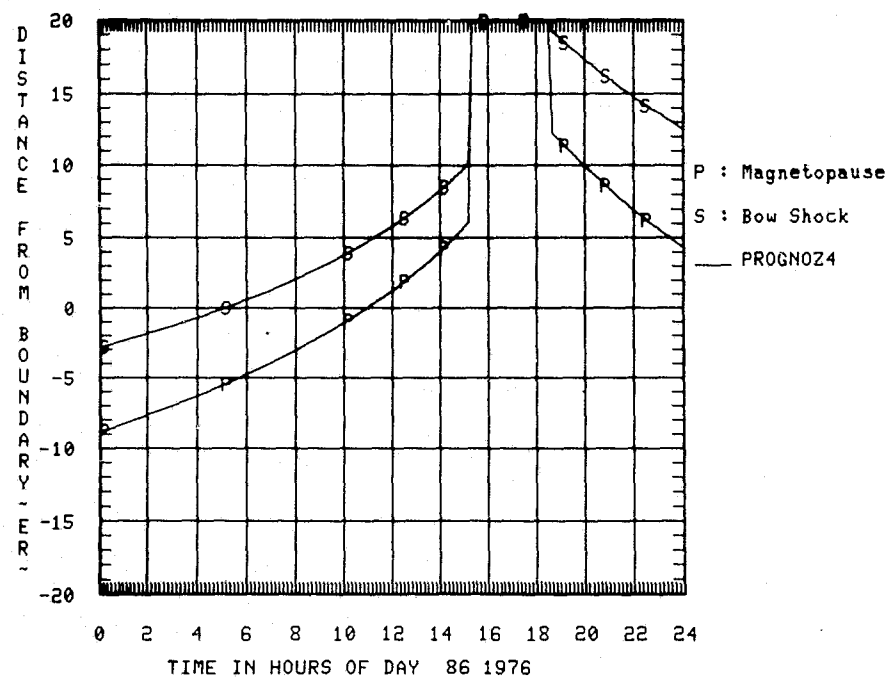
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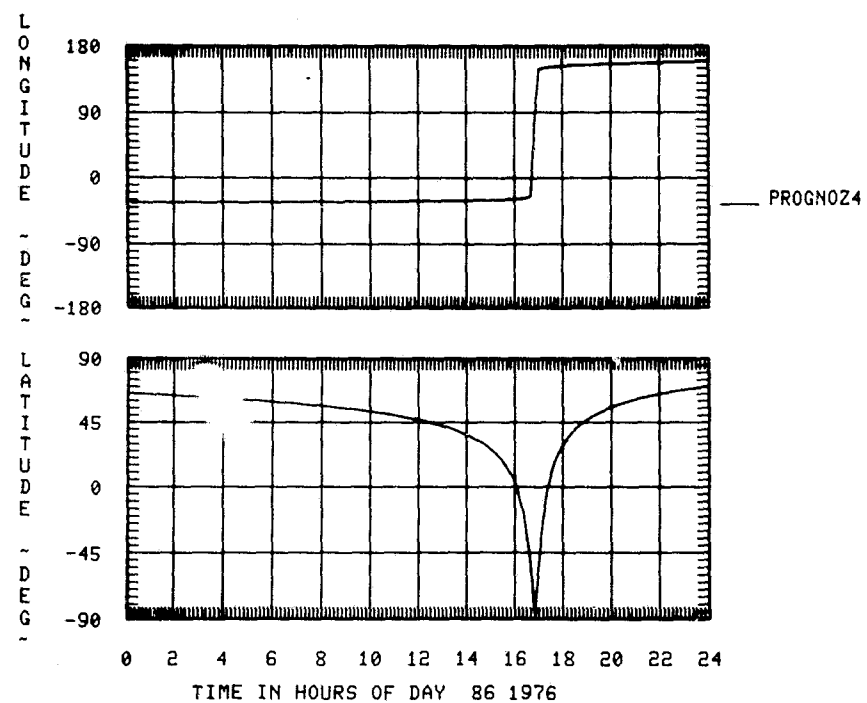
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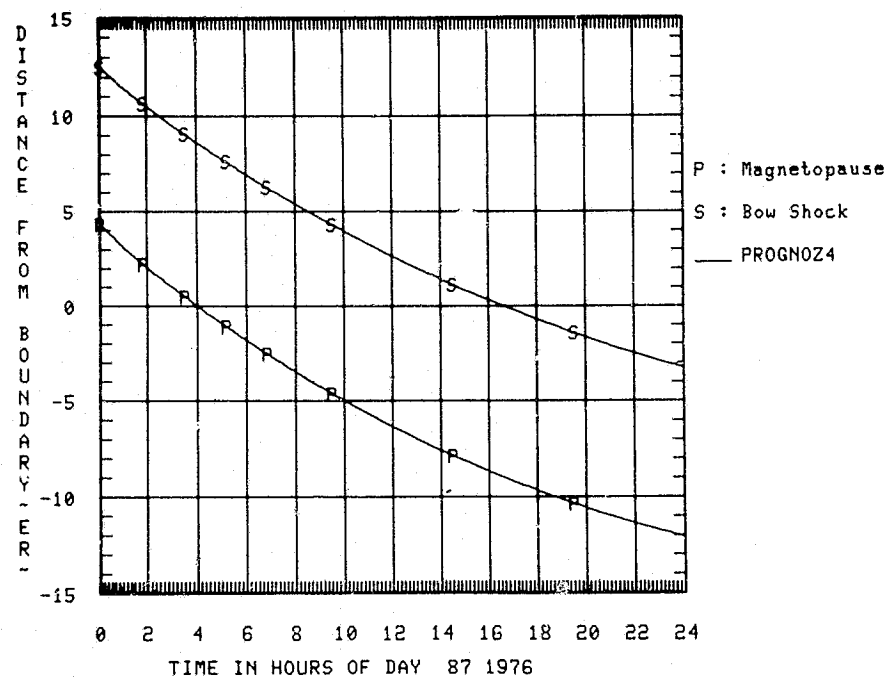
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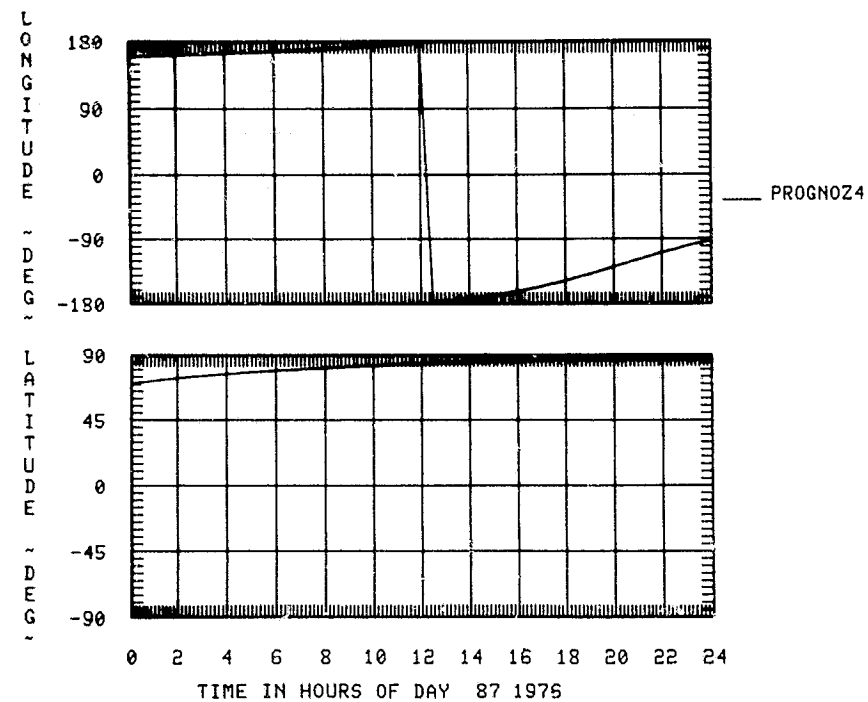
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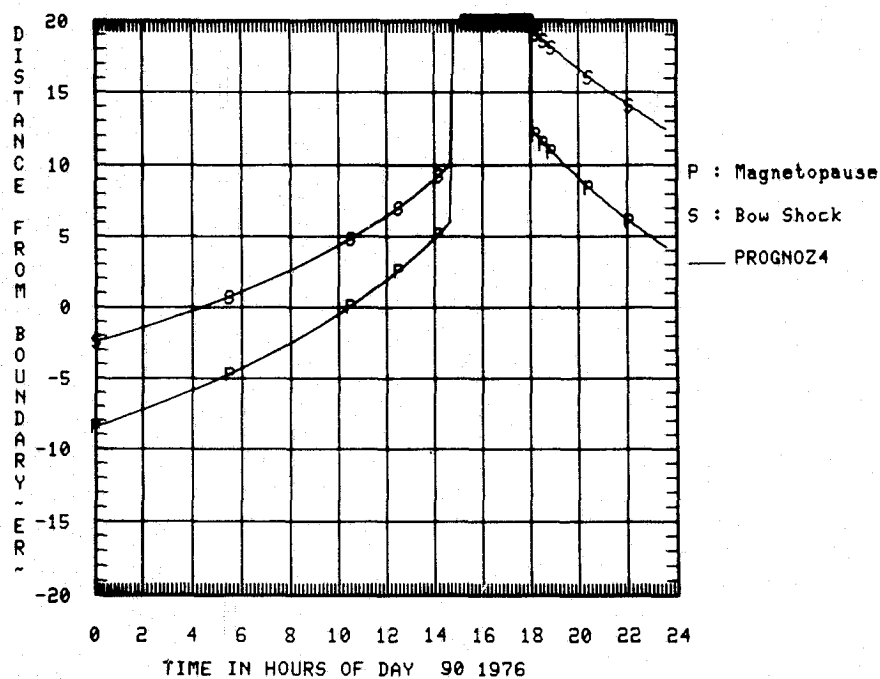
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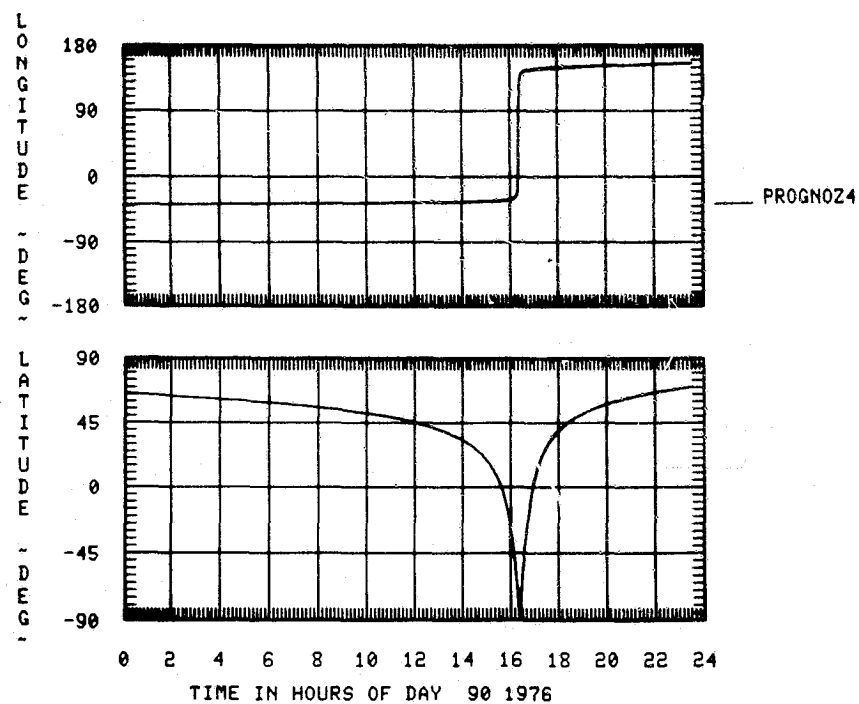
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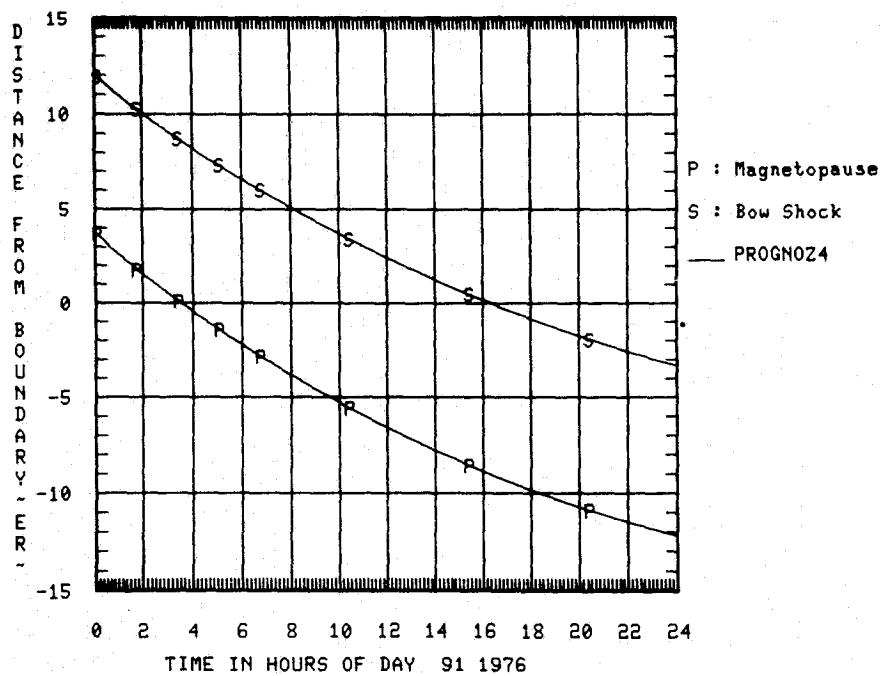


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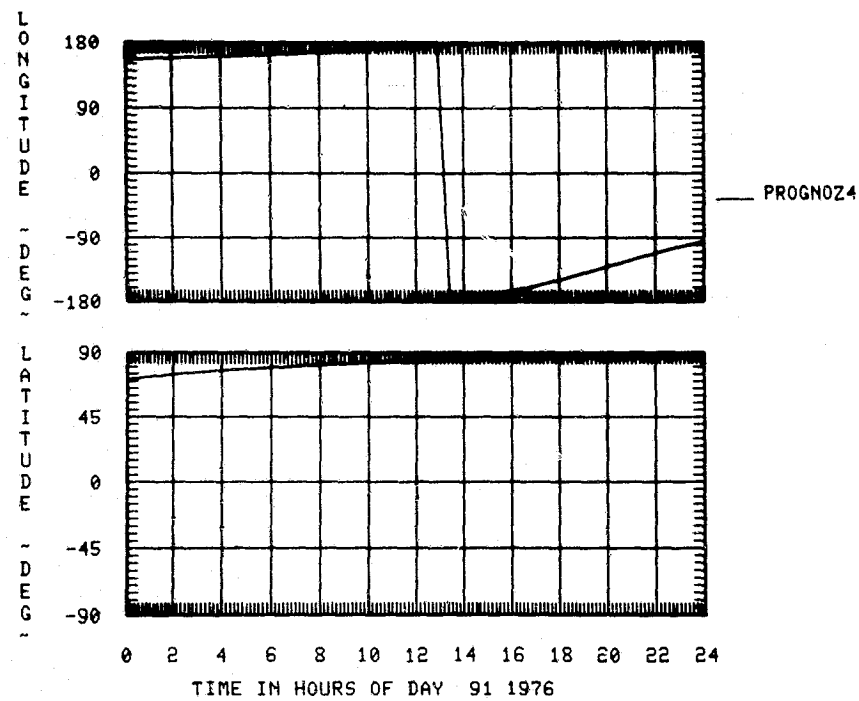
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BOUNDARY PLOT

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ECLIPTIC POLAR COORDINATES



APPENDIX D

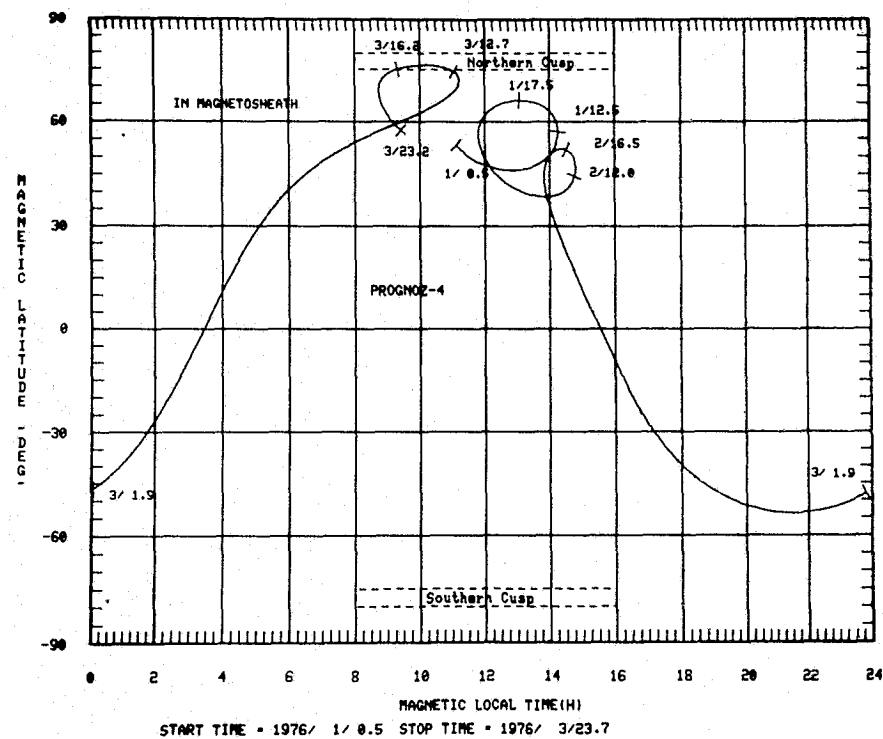
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VERSUS

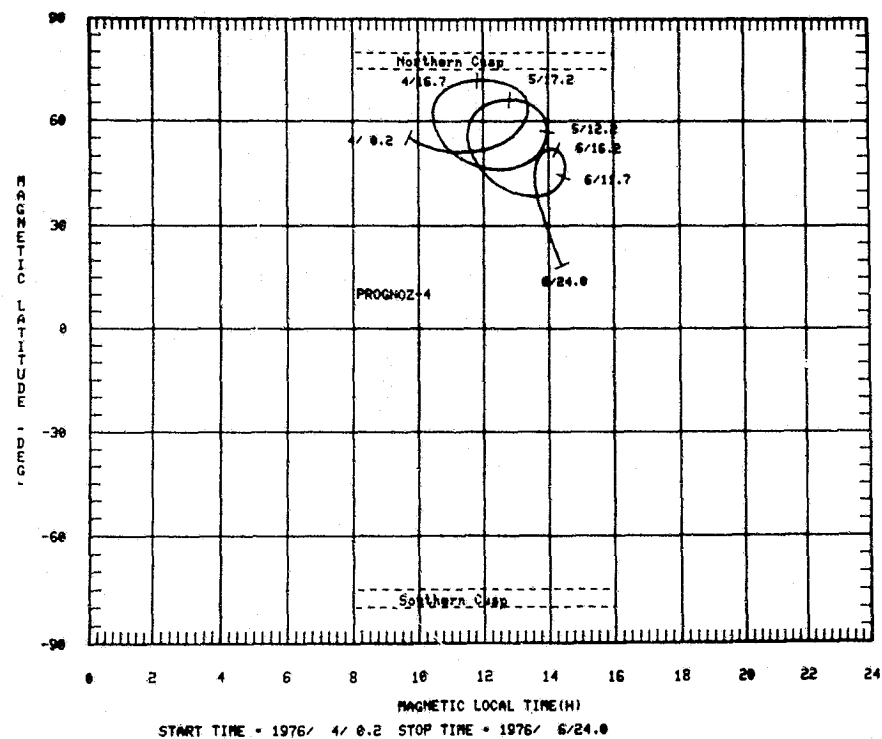
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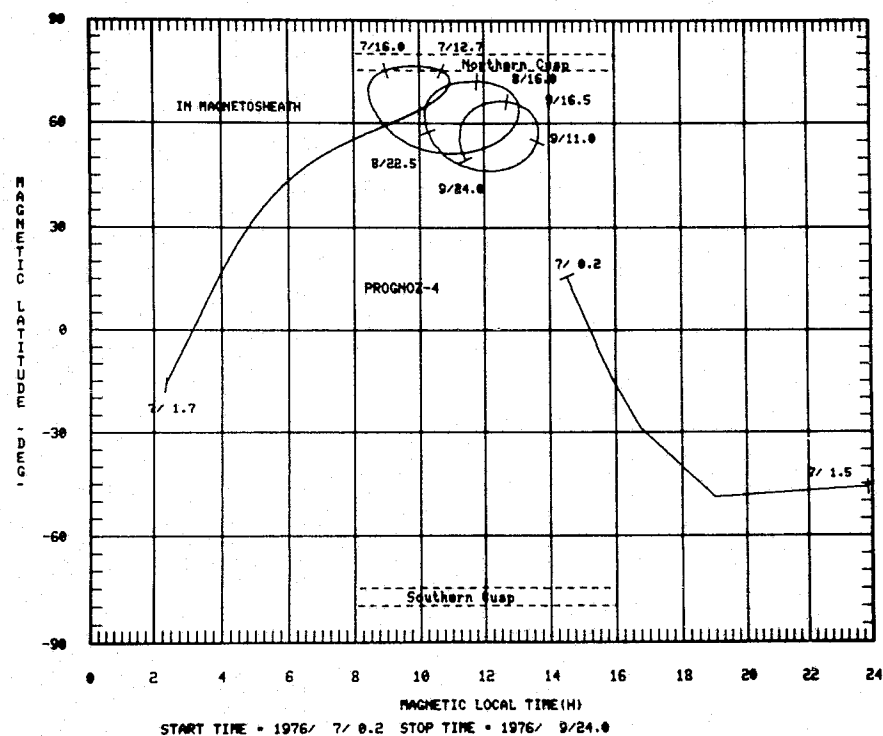
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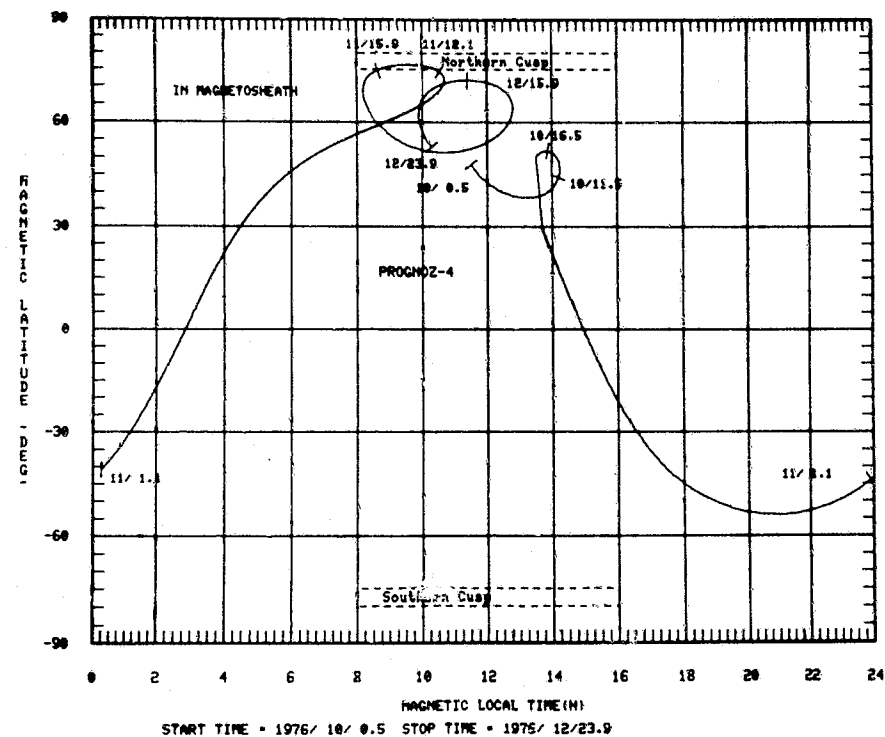
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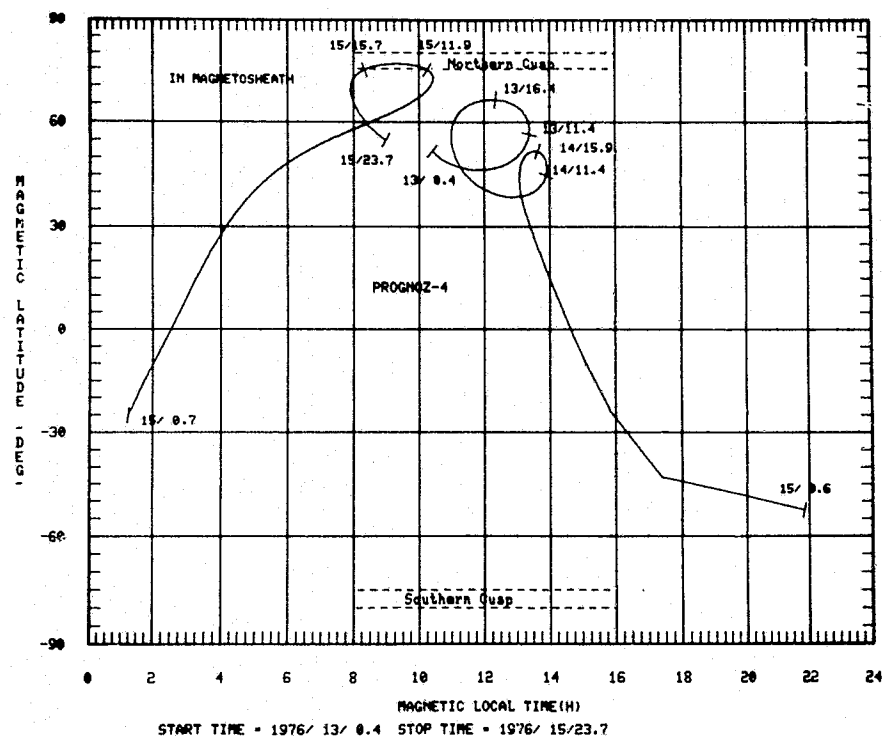
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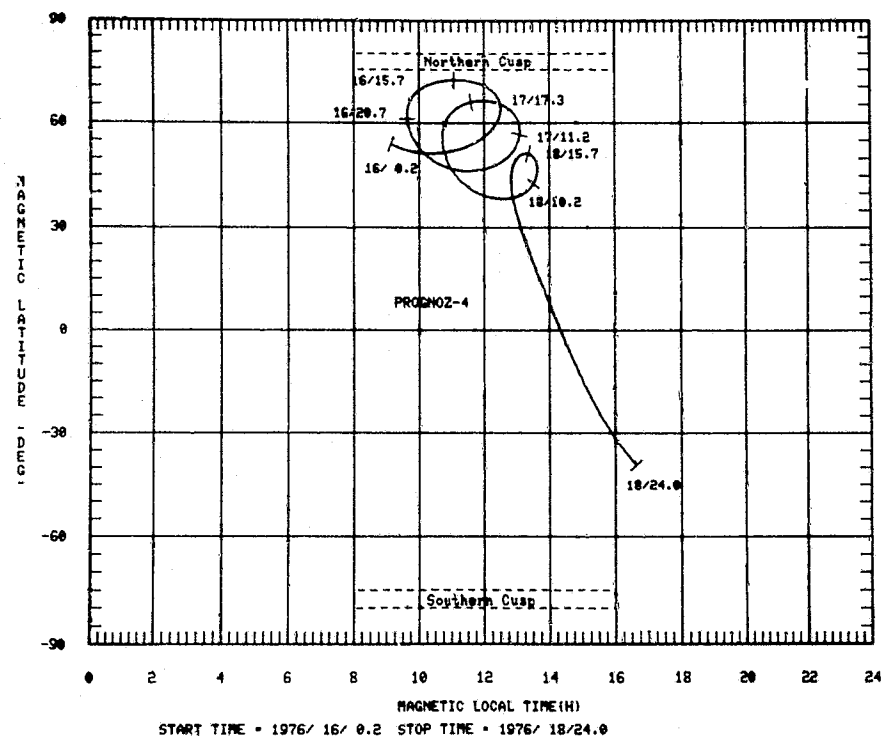
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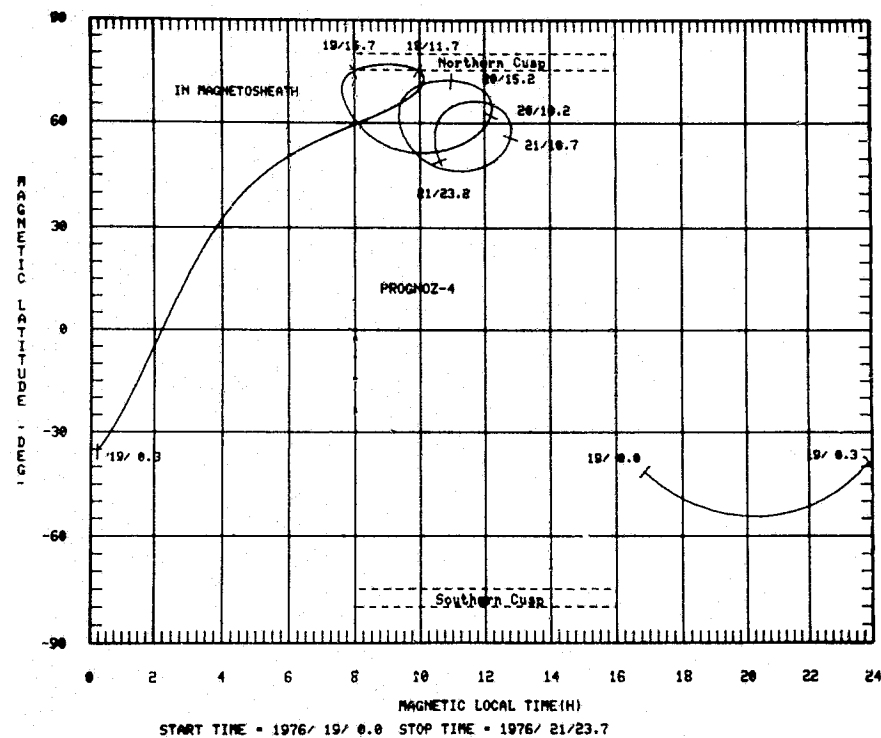
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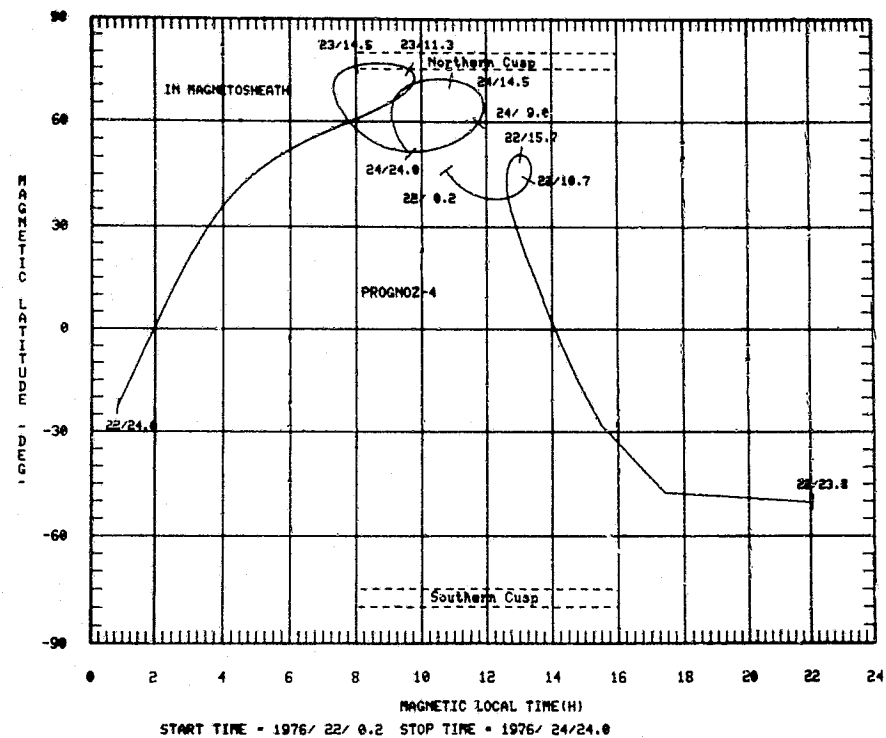
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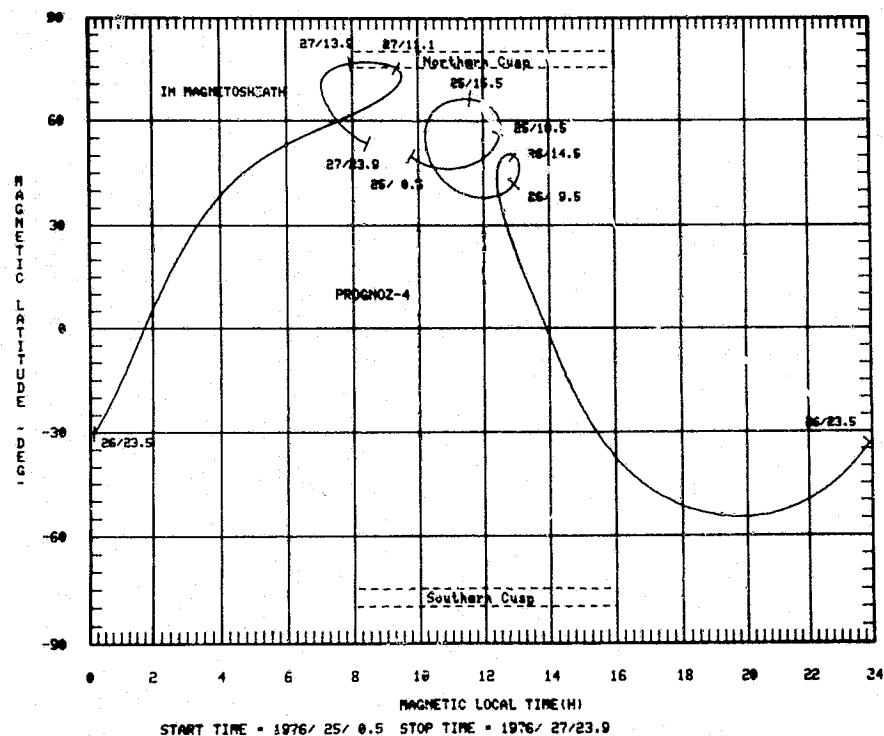
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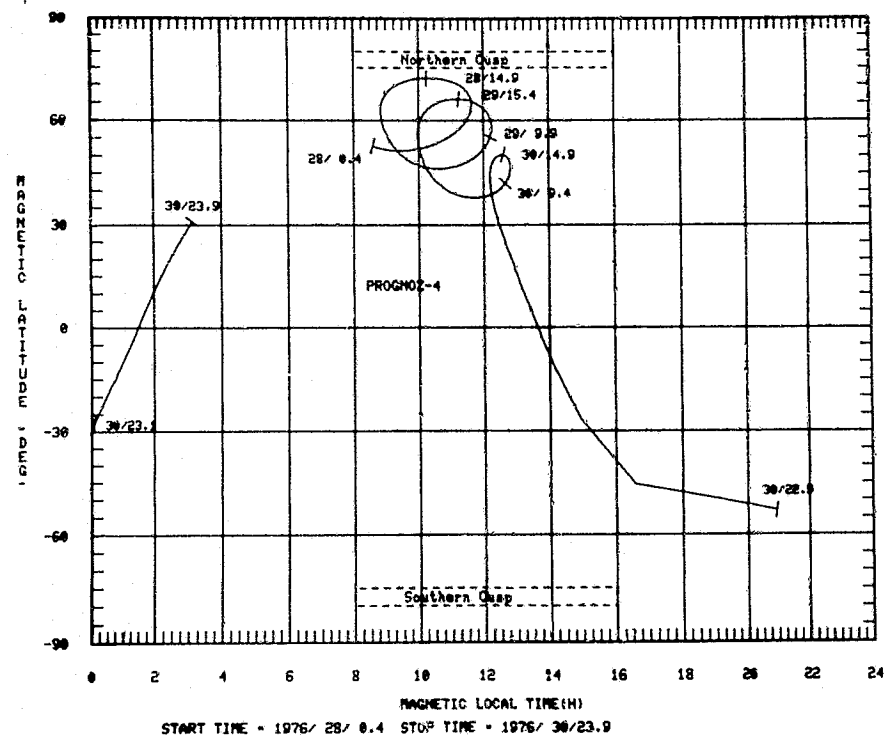
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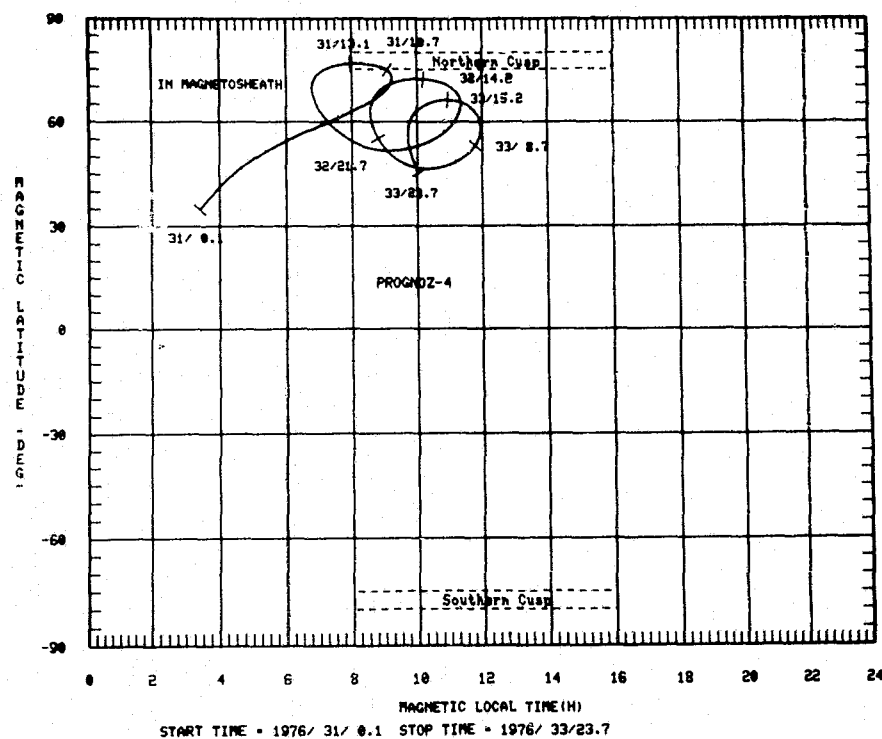
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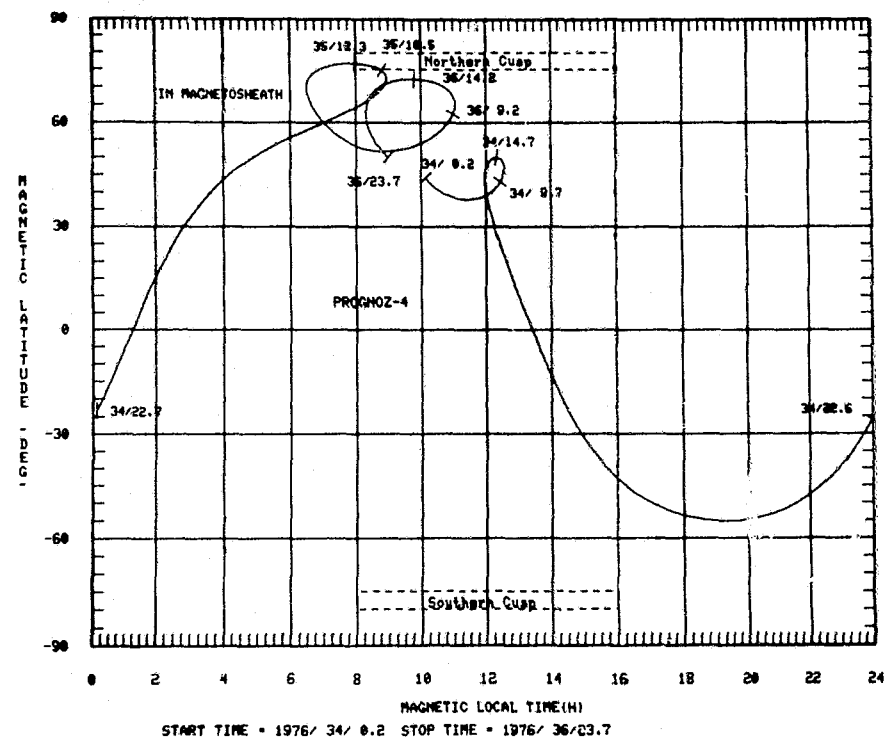
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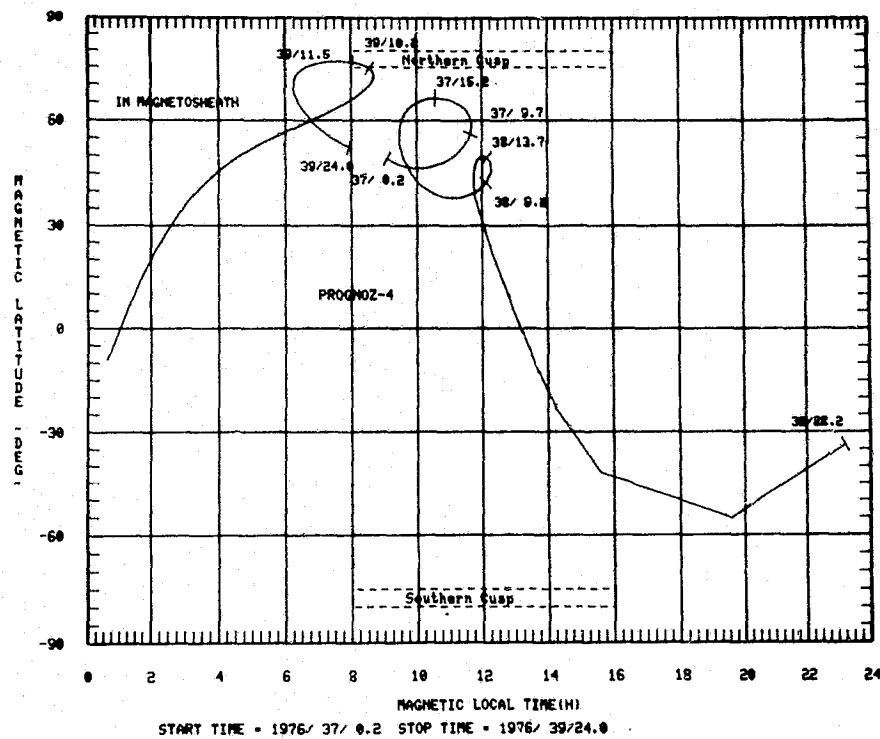
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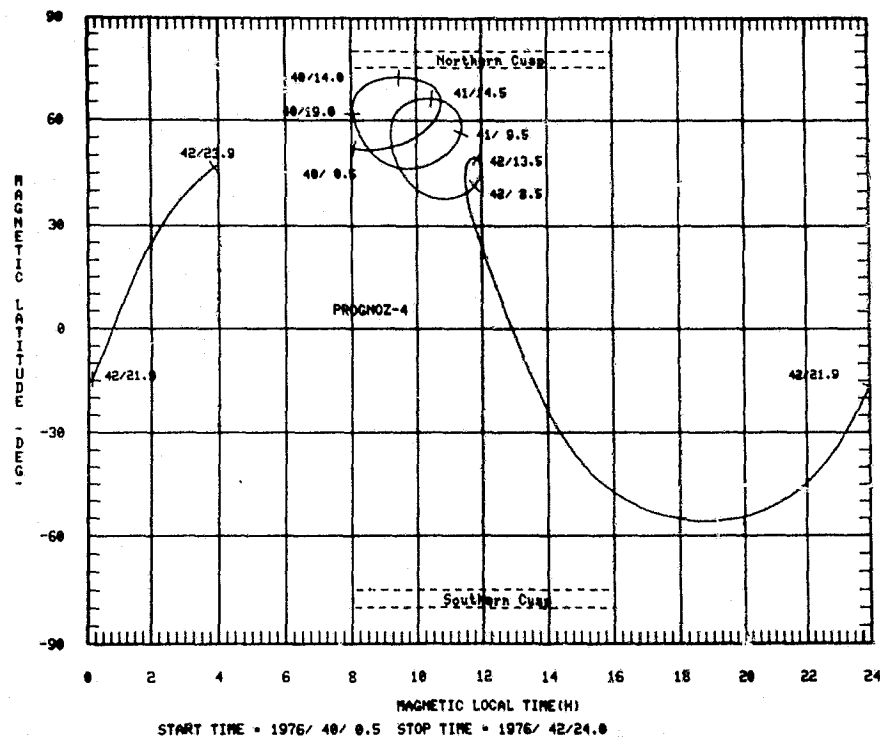
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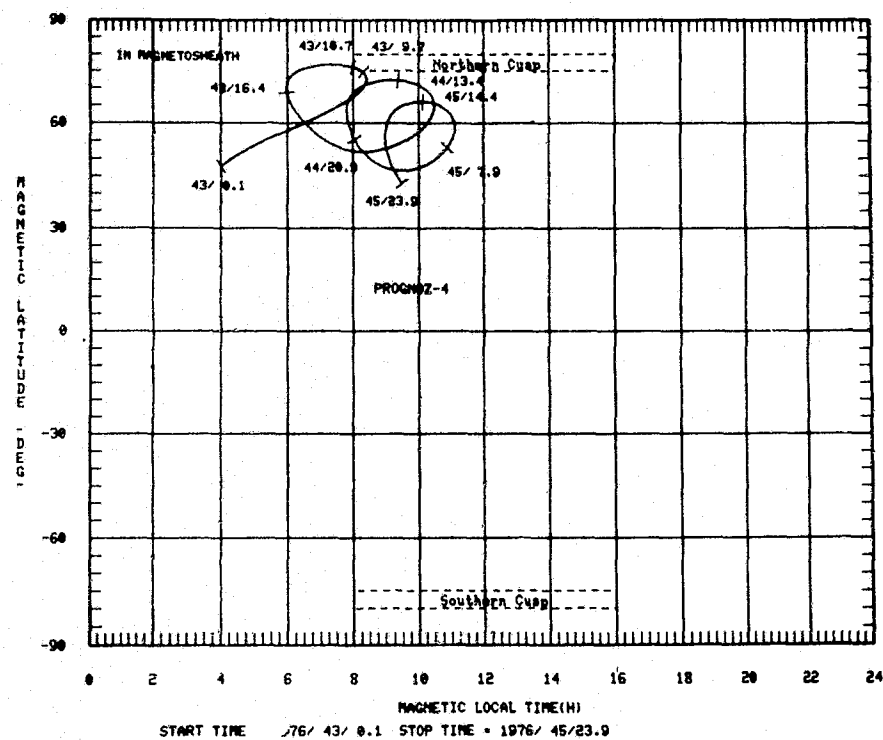
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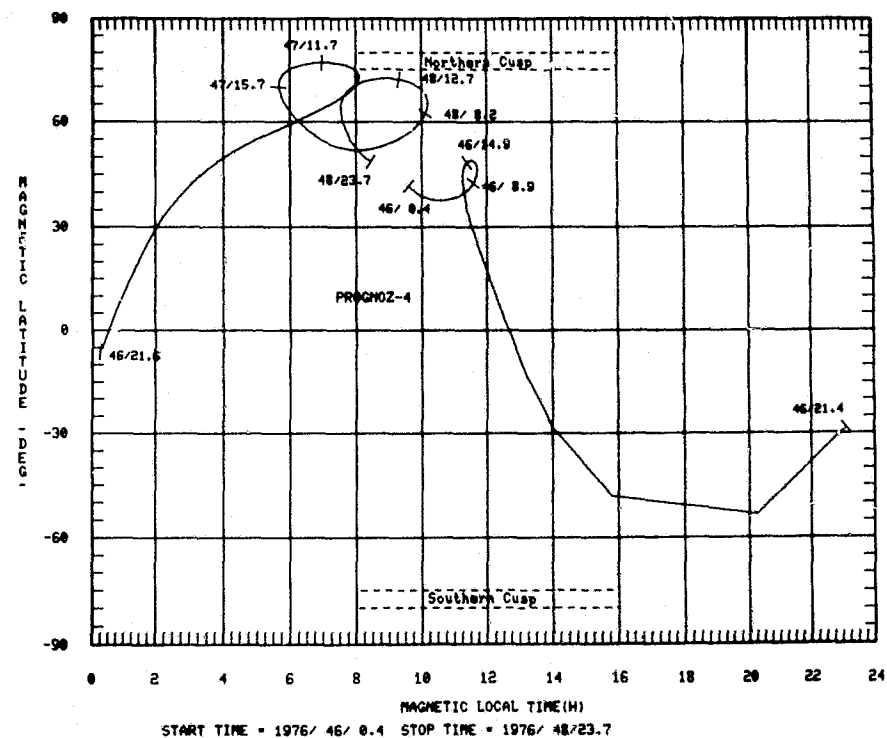
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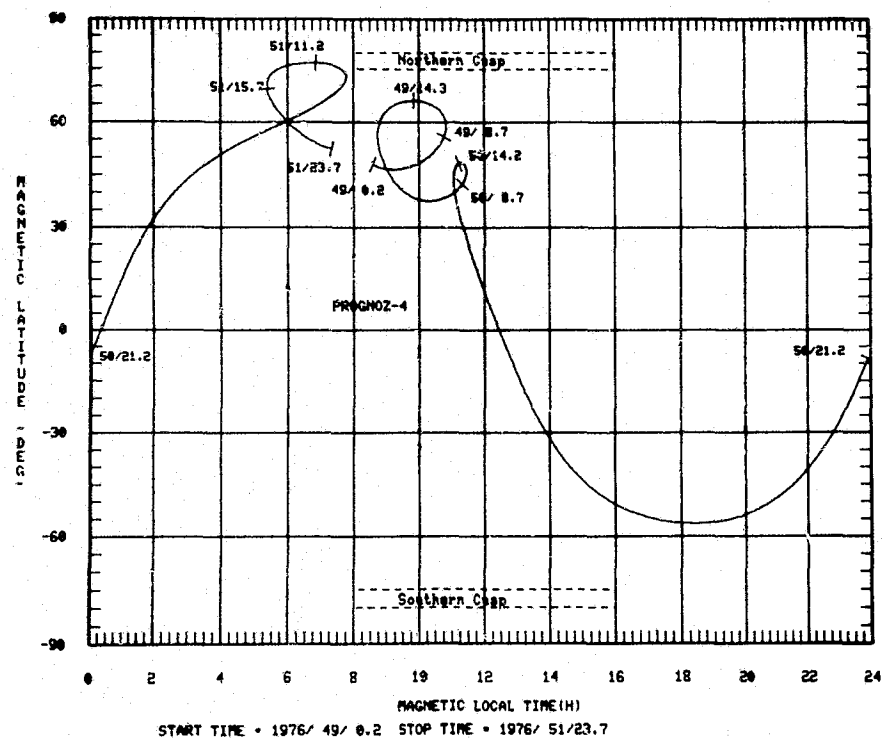
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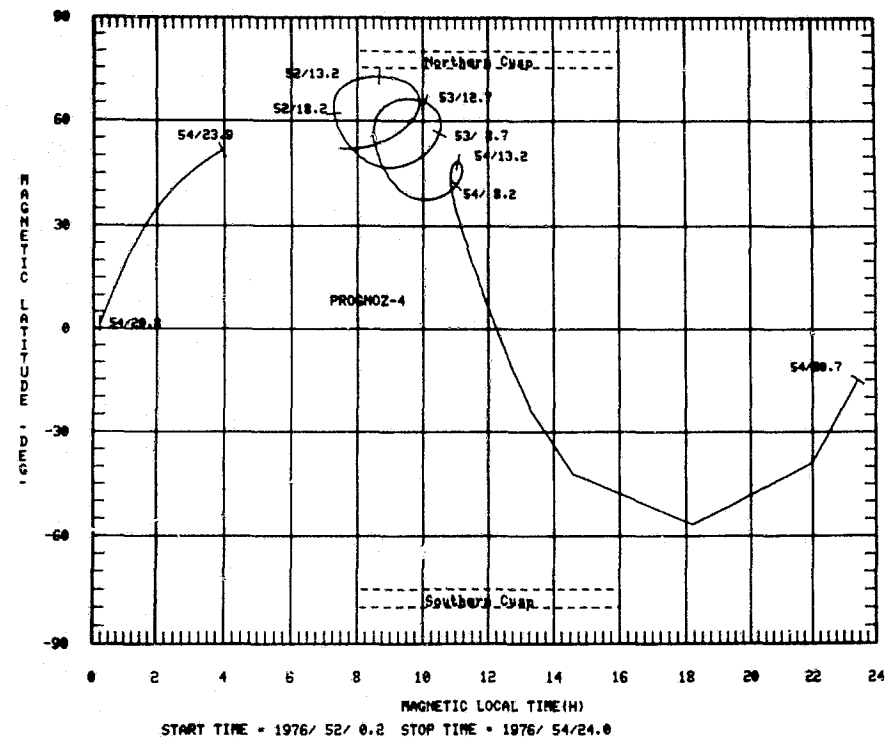
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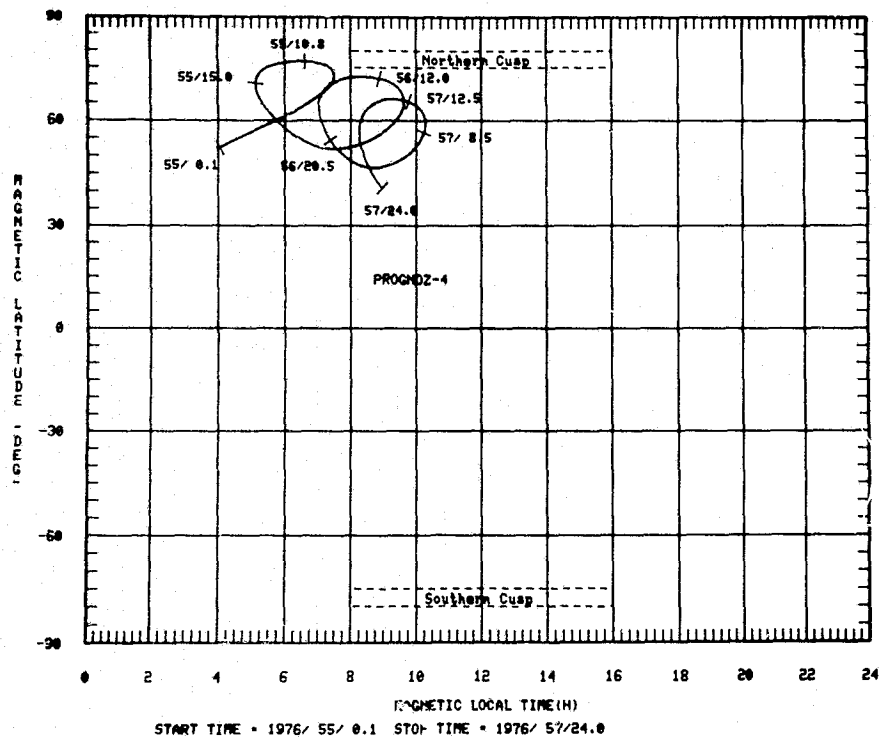
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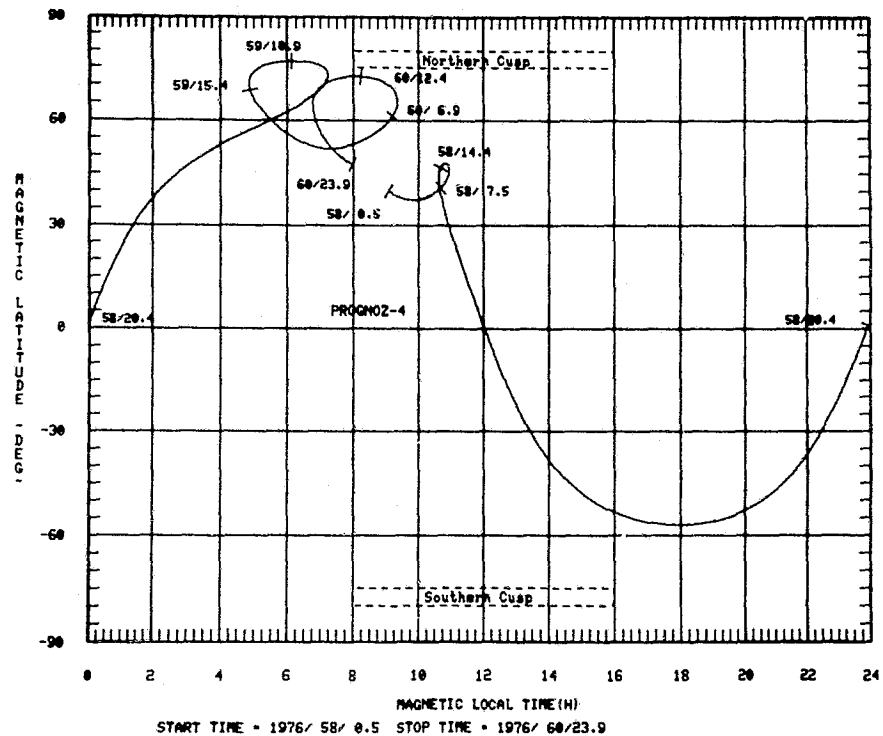
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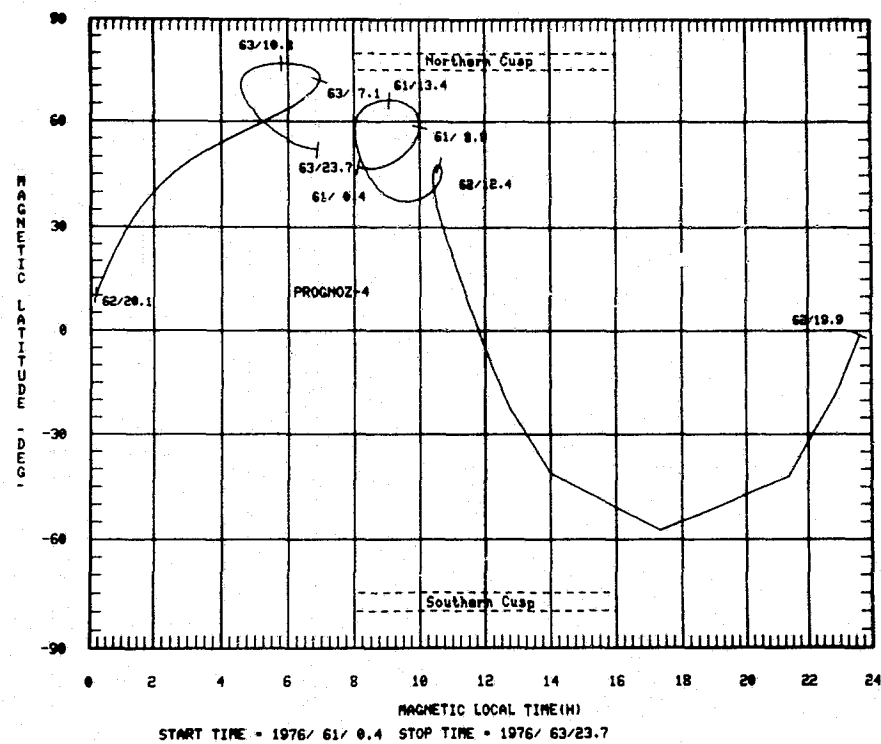
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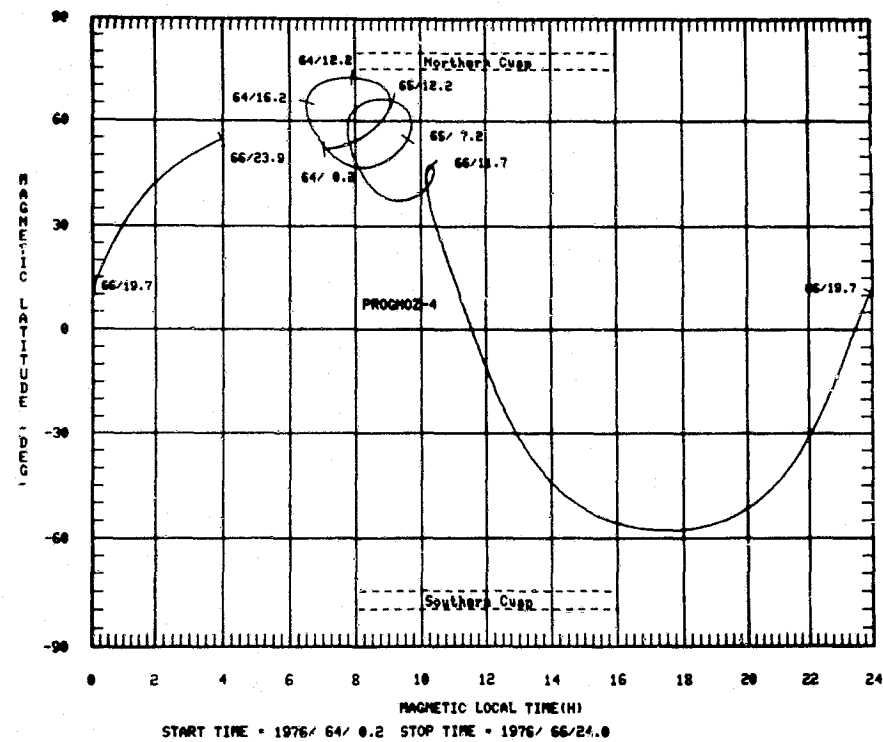
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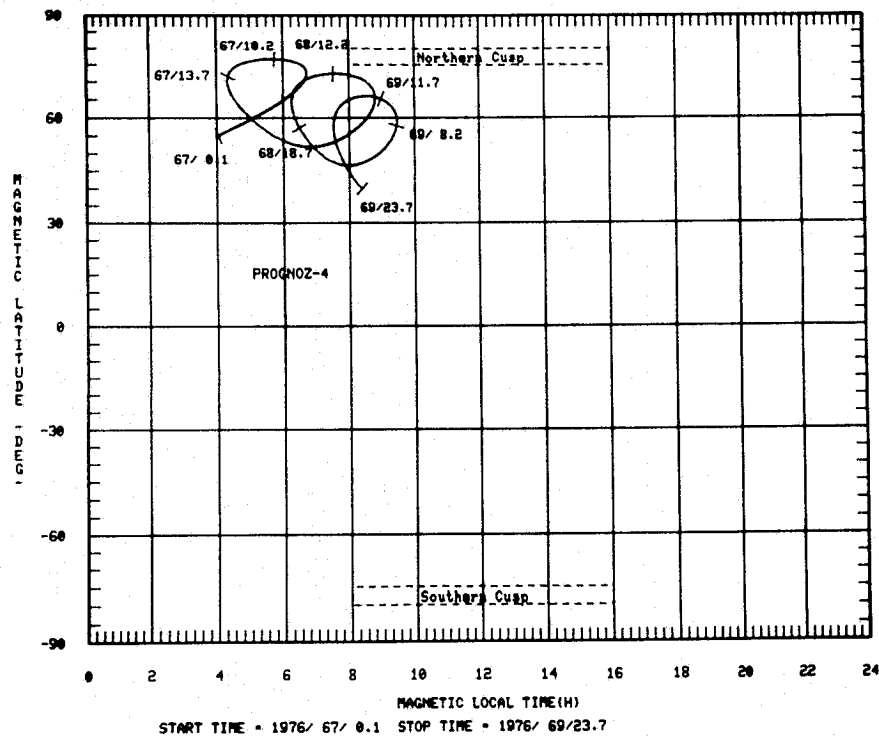
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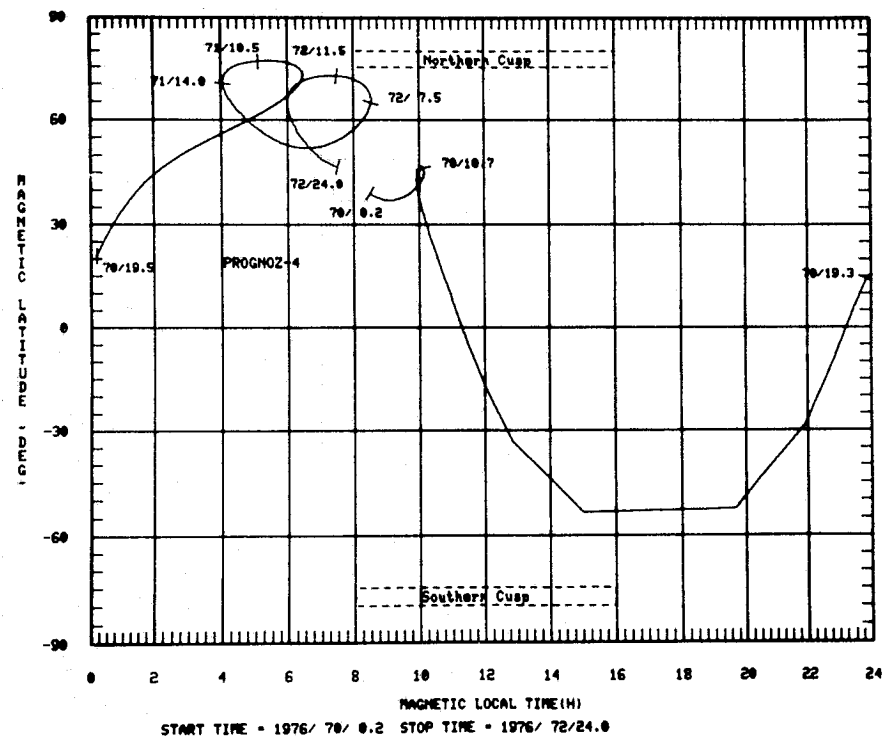
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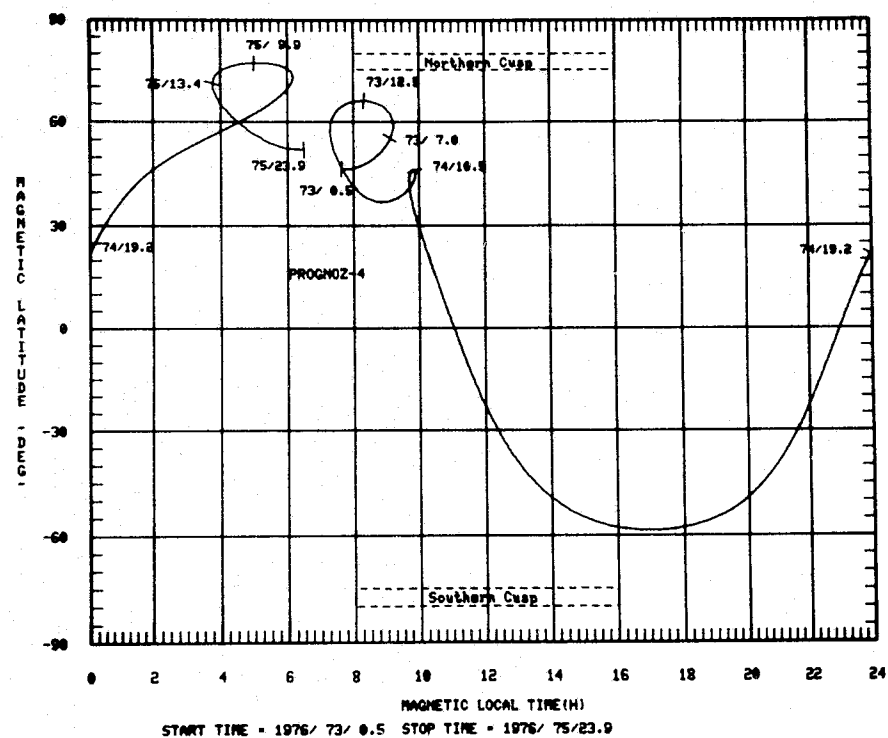
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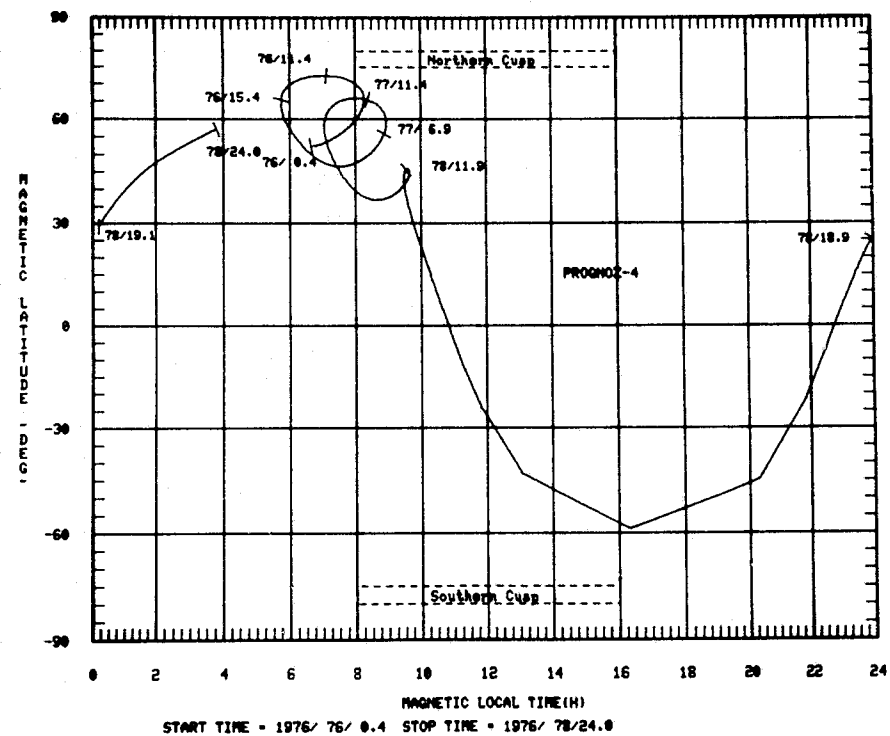
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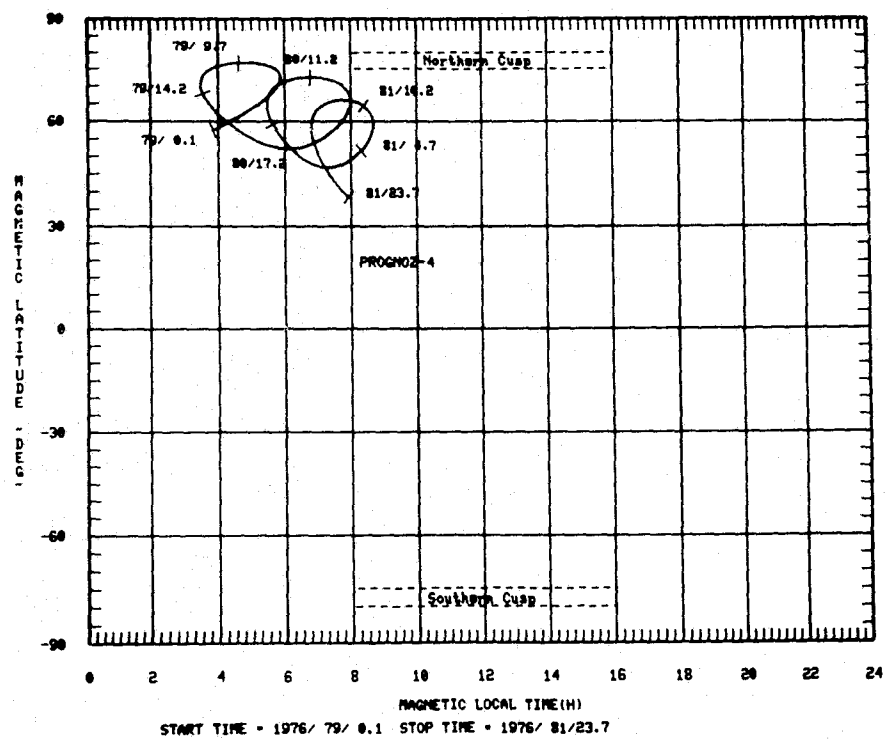
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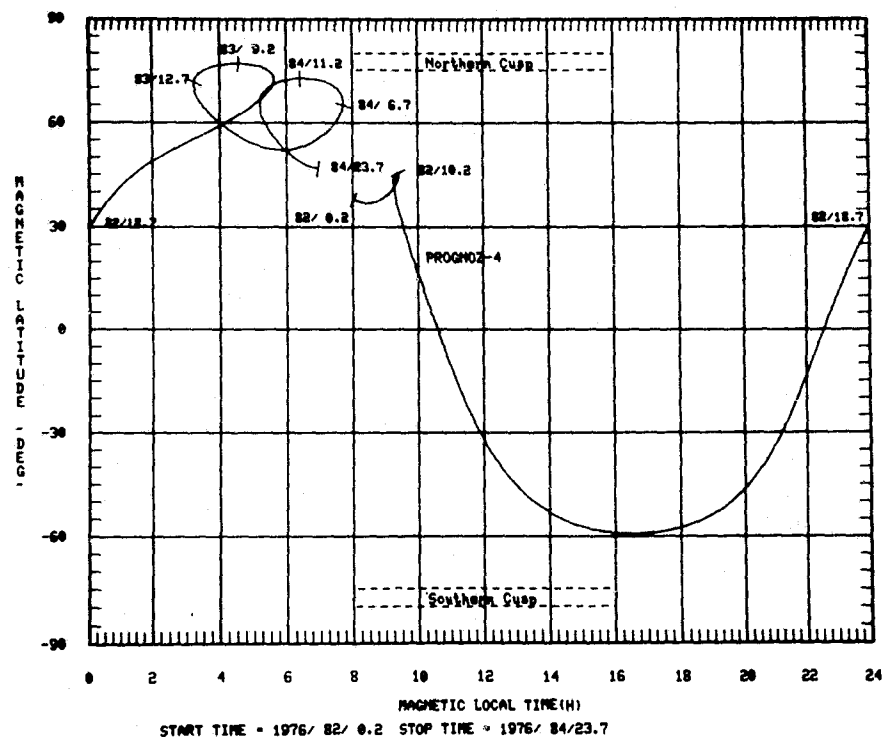
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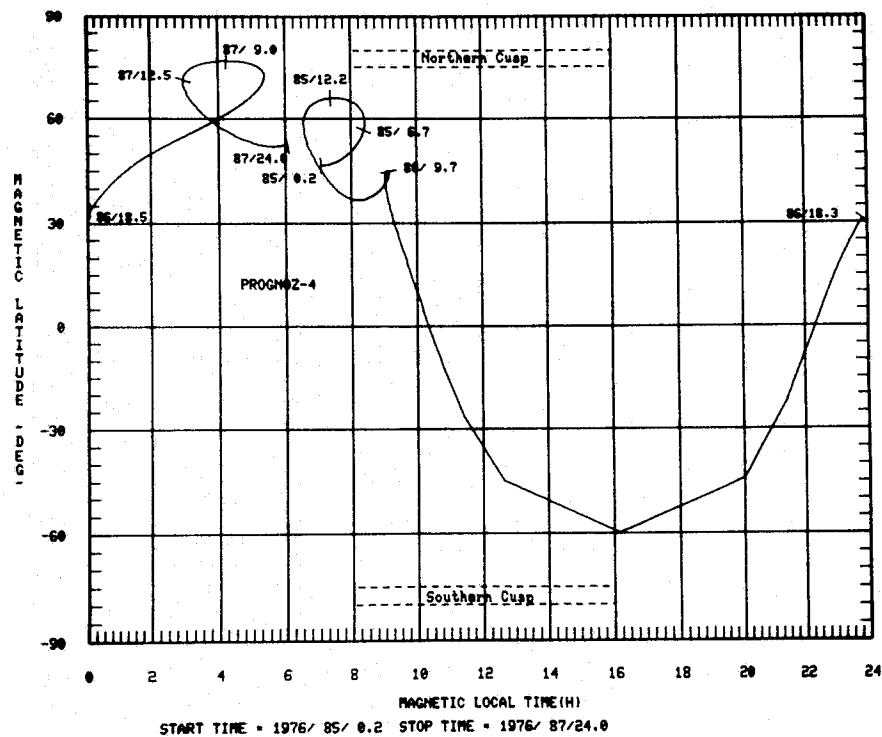
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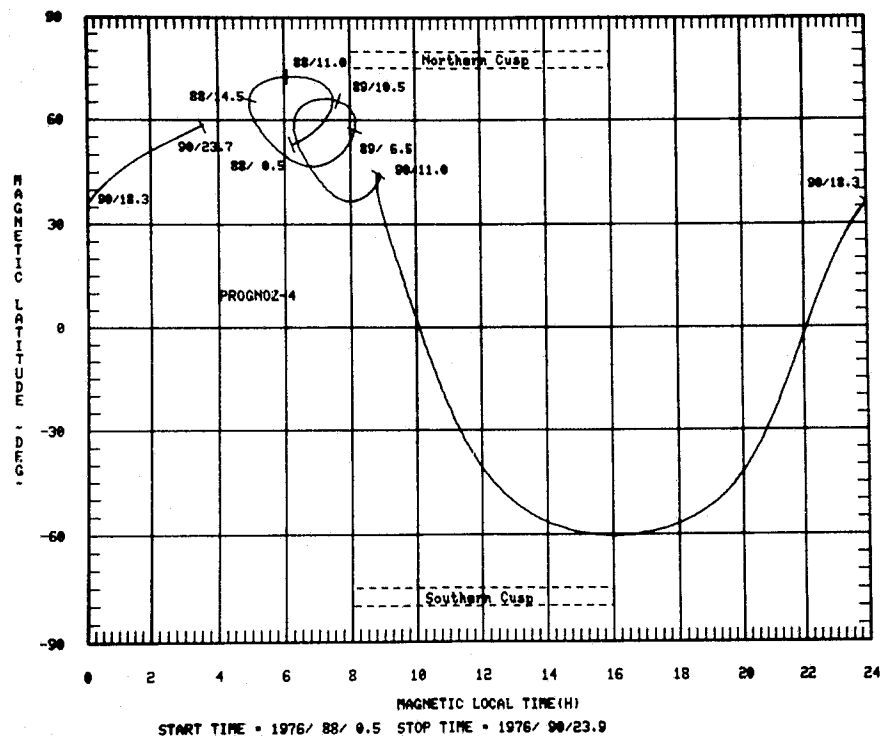
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MAGNETIC LATITUDE-MAGNETIC LOCAL TIME PROJECTION



MAGNETIC LATITUDE-MAGNETIC LOCAL TIME PROJECTION



MAGNETIC LATITUDE-MAGNETIC LOCAL TIME PROJECTION

